WL-TR-97-1112

FUTURE EMBEDDED COMPUTER SYSTEM SUPPORT TECHNOLOGIES (FEST)/ AUTOMATED VALIDATION (AUTOVAL)

VOLUME 4 - TESTMASTER™ EVALUATION REPORT FOR THE AUTOMATED VALIDATION (AUTOVAL) PROGRAM

ALAN D. SCHAAR, STEVEN A. WALTERS
SCIENCE APPLICATIONS INTERNATIONAL CORPORATION (SAIC)
4031 COLONEL GLENN HIGHWAY
BEAVERCREEK OH 45431

JULY 1996

FINAL REPORT FOR SEPTEMBER 1995 TO JULY 1996

Approved for public release; distribution unlimited.

AVIONICS DIRECTORATE
WRIGHT LABORATORY
AIR FORCE MATERIEL COMMAND
WRIGHT-PATTERSON AIR FORCE BASE OH 45433-7623

NOTICE

USING GOVERNMENT DRAWINGS, SPECIFICATIONS, OR OTHER DATA INCLUDED IN THIS DOCUMENT FOR ANY PURPOSE OTHER THAN GOVERNMENT PROCUREMENT DOES NOT IN ANY WAY OBLIGATE THE US GOVERNMENT. THE FACT THAT THE GOVERNMENT FORMULATED OR SUPPLIED THE DRAWINGS, SPECIFICATIONS, OR OTHER DATA DOES NOT LICENSE THE HOLDER OR ANY OTHER PERSON OR CORPORATION; OR CONVEY ANY RIGHTS OR PERMISSION TO MANUFACTURE, USE, OR SELL ANY PATENTED INVENTION THAT MAY RELATE TO THEM.

THIS REPORT IS RELEASABLE TO THE NATIONAL TECHNICAL INFORMATION SERVICE (NTIS). AT NTIS, IT WILL BE AVAILABLE TO THE GENERAL PUBLIC, INCLUDING FOREIGN NATIONS.

THIS TECHNICAL REPORT HAS BEEN REVIEWED AND IS APPROVED FOR PUBLICATION.

John A. Luke

JAHN A. LUKE
Project Engineer
Software/Hardware Technology Branch

James S. Williamson

JAMES S. WILLIAMSON, Acting Chief
Software/Hardware Technology Branch

Stanley E Wagner

STANLEY E. WAGNER, Chief
System Concepts & Simulation Division
Avionics Directorate

IF YOUR ADDRESS HAS CHANGED, IF YOU WISH TO BE REMOVED FROM OUR MAILING LIST, OR IF THE ADDRESSEE IS NO LONGER EMPLOYED BY YOUR ORGANIZATION PLEASE NOTIFY WL/AASH WRIGHT-PATTERSON AFB OH 45433-7623 TO HELP MAINTAIN A CURRENT MAILING LIST.

Do not return copies of this report unless contractual obligations or notice on a specific document requires its return.

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 074-0188

1. AGENCY USE ONLY (Leave blank)	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
	JULY 1996	FINAL (SEPTEMBER 1995 - JULY 1996)

4. TITLE AND SUBTITLE

FUTURE EMBEDDED COMPUTER SYSTEM SUPPORT TECHNOLOGIES (FEST)/AUTOMATED VALIDATION (AUTOVAL): VOLUME 4 - TESTMASTER™ EVALUATION REPORT FOR THE AUTOVAL PROGRAM

5. FUNDING NUMBERS

C F04606-89-D-0036/RZ04
PE 78012F
PR 3090
TA 01
WU 27

6. AUTHOR(S)

ALAN D. SCHAAR, STEVEN A. WALTERS

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)

SAIC
4031 COLONEL GLENN HIGHWAY
BEAVERCREEK OH 45431

8. PERFORMING ORGANIZATION REPORT NUMBER

RFFA56401

9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)

POC: JAHN A. LUKE, WL/AASH (937) 255-6548 ext. 3585
AVIONICS DIRECTORATE
WRIGHT LABORATORY
AIR FORCE MATERIEL COMMAND
WRIGHT-PATTERSON AFB OH
45433-7623

10. SPONSORING / MONITORING AGENCY REPORT NUMBER

WL-TR-97-1112

11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION / AVAILABILITY STATEMENT

APPROVED FOR PUBLIC RELEASE; DISTRIBUTION UNLIMITED.

12b. DISTRIBUTION CODE

13. ABSTRACT *(Maximum 200 Words)*

THIS REPORT DOCUMENTS AN EVALUATION OF TERADYNE'S TESTMASTER™ VERSION 1.6 SOFTWARE WITHIN THE CONTEXT OF A PILOT PROGRAM CONDUCTED BY SCIENCE APPLICATIONS INTERNATIONAL CORPORATION (SAIC) EMPLOYING THE AUTOMATED VALIDATION (AUTOVAL) VERSION 3.00U TOOLSET OF WRIGHT LABORATORY, AVIONICS DIRECTORATE, SYSTEM CONCEPTS AND SIMULATION DIVISION, SOFTWARE/HARDWARE TECHNOLOGY BRANCH (WL/AASH). THE TESTMASTER™ PILOT PROGRAM ASSESSED THE PERFORMANCE AND CAPABILITIES OF TERADYNE'S COMMERCIAL PRODUCT FOR USE IN TESTING EMBEDDED OPERATIONAL FLIGHT PROGRAM (OFP) SOFTWARE WITH AUTOVAL. A BACKGROUND SURVEY AND EXAMINATION OF THE PROGRAM GOALS AND APPROACH INTRODUCE A DISCUSSION OF TEST STRATEGIES AND AN ANALYSIS OF RESULTS. THE REPORT DESCRIBES APPLICABLE METRICS AND OFFERS RECOMMENDATIONS FOR FUTURE STUDY. TO EVALUATE THE POTENTIAL OF TESTMASTER™ IN REDUCING THE TIME AND EXPENSE OF OFP TESTING, ENGINEERS USED TESTMASTER™ TO MODEL A PORTION OF THE F-16A/B FIRE CONTROL SUBSYSTEM. THIS MODEL EMBODIED BOTH THE BEHAVIOR OF THE SUBSYSTEM AND COMPONENTS OF THE AUTOVAL TEST LANGUAGE, SO THAT TEST SCRIPTS PRODUCED BY TESTMASTER™ WERE AUTOVAL-COMPATIBLE. THESE AUTOMATICALLY GENERATED AUTOVAL TEST SCRIPTS WERE THEN RUN ON AN F-16A/B SOFTWARE TEST STATION TO ASSESS THEIR PERFORMANCE AND CAPABILITIES. TESTMASTER™ PROVED TO BE A CAPABLE TOOL, GENERATING THOUSANDS OF TESTS FOR VALIDATING THE SUBJECT OFP; HOWEVER, CONSTRAINTS MUST BE APPLIED TO REDUCE THIS NUMBER TO A MEANINGFUL SET, EXECUTABLE WITHIN THE GIVEN TIME AND BUDGET LIMITATIONS.

14. SUBJECT TERMS	15. NUMBER OF PAGES
FEST, AUTOVAL, TESTMASTER™, AVIONICS, SOFTWARE, TESTING	198
	16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED	SAR

CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

PREFACE

This is Volume 4 of the final report for the Air Force Materiel Command (AFMC) Wright Laboratory (WL) Avionics Directorate, System Concepts & Simulation Division, Software/Hardware Technology Branch (AASH) entitled Future Embedded Computer System (ECS) Support Technologies (FEST)/Automated Validation (AutoVal), which employed Design Engineering Program (DEP) contract Delivery Order (DO) RZ04. Jahn A. Luke was the Air Force Project Engineer and Mark M. Stephenson was the Air Force Technical Lead for the effort.

The work for this study was performed at SAIC's local facility and at the Embedded Computer Resources Support Improvement Program (ESIP) Laboratory (WL/AASH), Building 620, Wright-Patterson Air Force Base (WPAFB). Steven A. Walters was the SAIC Principal Investigator, and Alan Schaar was primary author for SAIC. Documentation support was provided by Bruce Schaffer, Patti Ogden, and Deby Trueblood of SAIC and Oneida Resources, Inc.

THIS PAGE INTENTIONALLY LEFT BLANK

1.0 SCOPE

1.1 Identification.

This report documents an evaluation of the TestMaster™ Version 1.6 software commercial product within a pilot program and environment employing the Automated Validation (AutoVal) Version 3.00u toolset of Wright Laboratory, Avionics Directorate, System Concepts and Simulation Division, Software/Hardware Technology Branch (WL/AASH). The identification number for the AutoVal toolset is FFA1512.

1.2 Purpose.

The TestMaster™ Pilot Program conducted by SAIC assessed the performance and capabilities of the Teradyne TestMaster™ commercial product for use in testing embedded Operational Flight Program (OFP) software in conjunction with WL/AASH's AutoVal toolset.

1.3 Document Overview.

This document describes the procedures followed and the results achieved during the TestMaster™ Pilot Program. A brief background survey and examination of the Program goals and approach in Section 3.0 provides a framework for the discussion of test strategies and results analyzed in Section 4.0. In addition, the report addresses applicable metrics and offers recommendations for future action.

THIS PAGE INTENTIONALLY LEFT BLANK

2.0 APPLICABLE DOCUMENTS

2.1 Government Documents.

The following documents of the exact issue shown form a part of this specification to the extent specified herein. In the event of conflict between the documents referenced herein and the contents of this specification, the contents of this specification shall be considered a superseding requirement.

SPECIFICATIONS:

16ZE591	Computer Program Development Specification (B5) for the F-16A/B Expanded Fire Control Computer (XFCC) Operational Flight Program Z1B Production Tape H2000 (Lockheed)

OTHER PUBLICATIONS:

MFFA55104	Software User's Manual for the Automated Validation (AutoVal) Program Version 3.00u
16PR9725	(Preliminary) F-16A/B Avionic System Manual (Block Z1B) (General Dynamics)

Copies of specifications, standards, drawings, and publications required by suppliers in connection with specified procurement functions can be obtained from the contracting agency or as directed by the contracting officer.

2.2 Non-Government Documents.

The following documents of the exact issue shown form a part of this specification to the extent specified herein. In the event of conflict between the documents referenced herein and the contents of this specification, the contents of this specification shall be considered a superseding requirement.

Teradyne Software & System Test	Using TestMaster™ (Teradyne)
Teradyne Software & System Test	Introduction to Modeling With TestMaster™ (Teradyne)
ISBN 0-471-12094-4	Black Box Testing Techniques for Functional Testing of Software and Systems

Technical society and technical association specifications and standards are generally available for reference from libraries. They are also distributed among technical groups and using Federal agencies.

3.0 APPROACH

3.1 Background.

The current U.S. Department of Defense (DOD) approach to Operational Flight Program (OFP) testing is a very labor intensive manual process, both in the design of the tests and in their execution. The number of OFP source lines of code that must be tested in weapon systems within the DOD is increasing at an exponential rate due to the rapidly increasing number of embedded computers and also due to the even more rapid expansion of the performance and memory capacities of these computers. At the same time, the Government is attempting to reduce costs by closing facilities and cutting back staffing. The result of the collision of these two opposing forces is that complete regression testing of new OFP releases may give way to increasingly sparse "spot checks". The current manual approach to testing will be inadequate to maintain full testing of embedded software through the end of the decade. As software takes over more and more functions within our weapon systems, the potential consequences of inadequate software testing are taking on new and potentially frightening proportions.

Wright Laboratory (WL) recognized this dilemma almost a decade ago and began research to provide a solution based on automation of the OFP testing process. This research led to the development of a toolset called AutoVal (for Automated Validation) that automates the execution of OFP Formal Qualification Tests (FQTs) on the test stations within an Avionics Integration Support Facility (AISF) or System Integration Laboratory (SIL). AutoVal has been fielded for more than four years and has demonstrated a 100-to-1 reduction in the time needed to conduct FQTs and other forms of empirical regression tests of OFP software.

After AutoVal had matured adequately, WL and SAIC focused their research on reducing the time required for test design. This initially involved improving the efficiency of AutoVal test script development by enhancing AutoVal to incorporate a language sensitive test script editor within a sophisticated and intuitive Graphical User Interface (GUI). We also implemented a "Learn Mode" that can monitor the actions of a test engineer on a test station and automatically generate an AutoVal test script to replicate those actions.

Our current research is now considering the possibility of automating the test design process, itself, based on a description of the embedded system requirements and operational concept. Within the last year, Teradyne, Inc., has introduced a commercial product called TestMaster™ that can automatically generate test scripts from a behavioral model of the system under test (embedded computer and OFP software together). The process isn't entirely automatic because an engineer must still apply the system requirements and operational concept to manually create the model. Once created, however, the model may be used with TestMaster™ to automatically create a wide variety of very detailed and thorough tests of the system.

Based on the potential this product holds for further reducing the time and expense of OFP testing, WL initiated a pilot program to evaluate the application of TestMaster™ to a representative subset of a typical weapon system OFP testing domain. SAIC AutoVal engineers used TestMaster™ to model a portion of the F-16A/B Fire Control subsystem. This model

embodied both the behavior of the subsystem and components of the AutoVal test language so that the test scripts produced by TestMaster™ were AutoVal-compatible. We then ran these automatically generated AutoVal test scripts on an F-16A/B software test station to assess their performance and capabilities. This report documents the results of this TestMaster™ Pilot Program.

3.1.1 Pilot Program Goals.

The goal of the TestMaster™ Pilot Program was to determine if the TestMaster™ automatic test program generator, in conjunction with the AutoVal technology, can be used to assist the test engineer in developing a suite of OFP tests with less effort and at lower cost when compared with traditional approaches. The following specific goals were considered in making the overall determination:

- Ease of integration with the AutoVal test harness
- Overall cost of implementation
- Comparative cost of implementation with traditional FQT processes
- Resultant test quality improvement
- Ancillary benefits beyond testing
- Overall benefit of TestMaster™/AutoVal combination for OFP testing

3.1.2 Pilot Program Tasks.

SAIC performed the following tasks in conducting this pilot program:

- Understand current Air Force OFP testing practices
- Learn black-box test techniques
- Become familiar with TestMaster™
- Select an F-16A/B subsystem to model
- Develop a TestMaster™ modeling style (test strategy) for avionics testing
- Model the F-16A/B selected subsystem with TestMaster™
- Run the TestMaster™ generated test programs (scripts) using AutoVal on an F-16A/B software test station
- Compare the developmental effort and testing coverage achieved to that of a traditional approach

3.2 Current Avionics Testing Practices.

The first step in the TestMaster™ Pilot Program was to review and characterize existing OFP testing approaches. Our observations included the review of representative FQTs and our previous experience in fielding avionics software test stations and AutoVal technologies at Air Force Air Logistic Centers (ALC's).

Figure 1 provides an overview of the current approach to OFP formal qualification testing. When a change is made, the OFP engineer readies a new load for testing. While the OFP engineer is finalizing the modifications to the OFP, the test engineer is preparing and/or updating the FQT. When both items are complete, the test engineer then conducts the test in accordance with the FQT and analyzes the results. Any errors are reported back to the OFP engineer for corrective action.

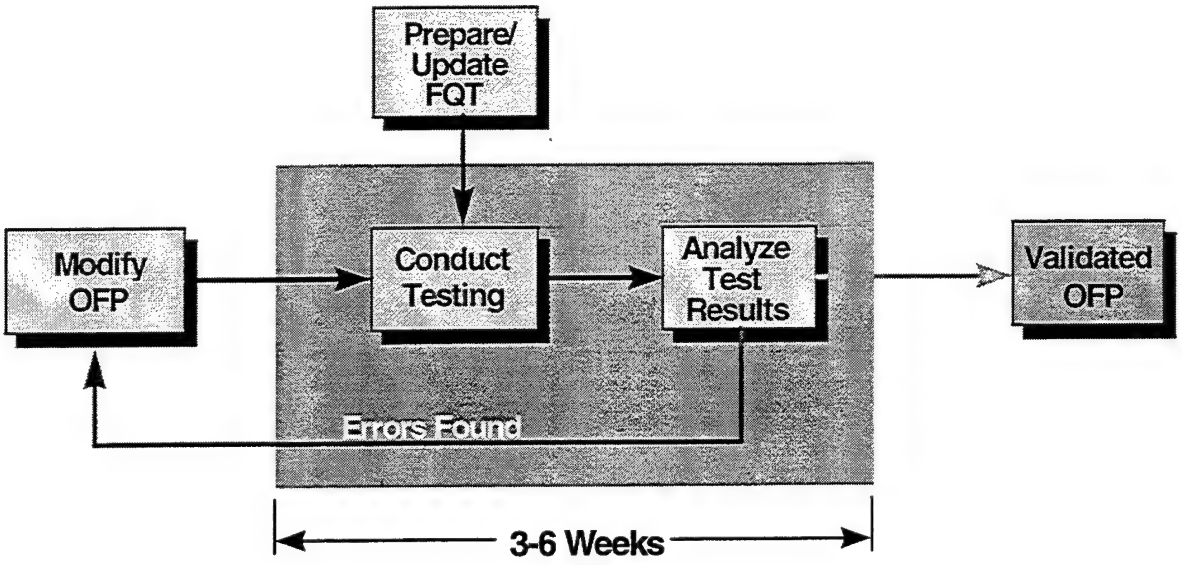


FIGURE 1. CURRENT APPROACH TO OFP TESTING

This approach contains several activities ("Prepare FQT", "Conduct Testing" and "Analyze Test Results") that are highly manual and rote in nature. Much of the time consumed by the testing process involves both manual test generation and manual execution of the individual FQT steps. Post-run data reduction and analysis of the test data generated during the test often consumes a great deal of time, also. The data is sometimes difficult to analyze due to its large volume and often unannotated and/or cryptic numeric formats. Combined with post-run analysis, these are significant drivers of long OFP turnaround cycles. The pertinent characteristics of this current approach are:

- A representative FQT requires 10 to 12 man-years to generate.
- Typical FQT test execution cycles require the labor of 2 to 3 engineers over a 3 to 6 week period for a total effort of 6 to 18 man-weeks per test cycle.
- The typical FQT test execution cycle comprises 500 to 5,000 total test sequences applied to the system-under-test (depending on system complexity and the way that tests are subdivided).
- The typical weapons system product lifecycle spans 20 years, during which there is an average of approximately 1 block and 4 tape upgrades per year in the first 12 years decreasing to 1 tape upgrade per year and a block upgrade every 2-4 years in the final 8 years.

The specific OFP we used for this pilot program was the F-16A/B Block 15Z1B Expanded Fire Control Computer (XFCC) software. We selected this particular OFP because an F-16A/B dynamic test station and a full set of Block 15Z1B XFCC documentation were readily available, and because this OFP represented most avionics systems well. It was our intent to conduct the pilot program in a way that would permit our results to be extrapolated to OFP tests in general.

The FQTs for the F-16A/B Block 15Z1B that were reviewed indicate that the approach generally followed for FQTs is a "positive case" style of testing. Each FQT that the test engineer performs is generally a single pass through the functionality of the subsystem under test with little to no time or resources allocated to "negative case" testing. A positive test is a set of test sequences with valid input data that should be "accepted" by the test target and deliver "correct" results. In a negative test case, either (1) invalid input data is applied to see if the system will properly "trap" this information and perform a controlled recovery so as to prevent the system from performing in an unpredictable manner, or (2) valid test sequences and valid input data are provided to the system and the system is checked for incorrect responses from portions of the system that should not have been affected.

3.3 Automated Avionics Testing.

One solution for increasing testing efficiency and reducing OFP testing turnaround time is to automate the execution and verification of the FQTs. The AutoVal tool performs this type of automation. AutoVal runs on a workstation computer and interacts through the test station with the OFP under test (see Figure 2). It utilizes a test-oriented command language featuring user-defined macros to tailor commands to the requirements of specific OFP test steps. Test engineers create command files with the appropriate AutoVal commands and macros to reproduce the FQT for the OFP under test. These commands and macros are used to replicate the operator's manual control of the system and to intercept and validate outputs from the OFP. If discrepancies are found, the test report can be reviewed to determine the nature of the unexpected behavior.

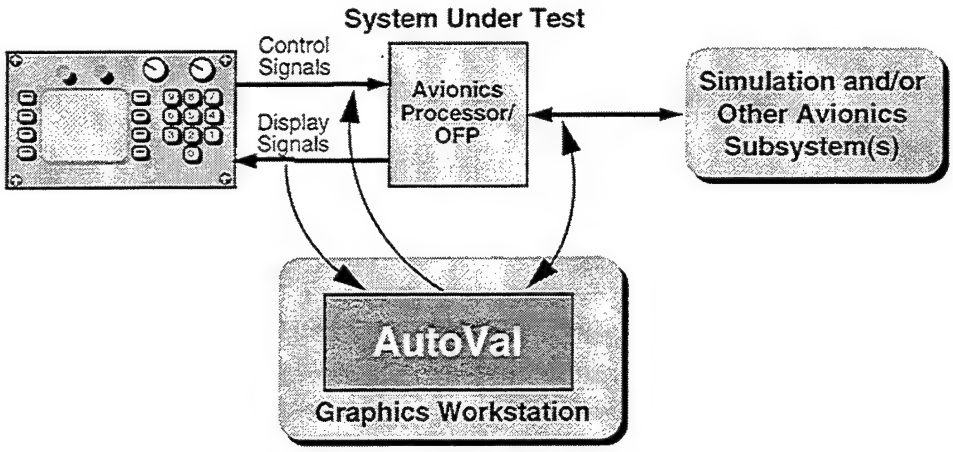


FIGURE 2. AUTOVAL SYSTEM DIAGRAM

AutoVal reduces the turnaround time associated with OFP validation by automating the stimulus and the verification of the OFP (see Figure 3). The AutoVal system is capable of accurately and repeatedly executing the AutoVal command files that contain the necessary macros and commands to perform the appropriate FQT.

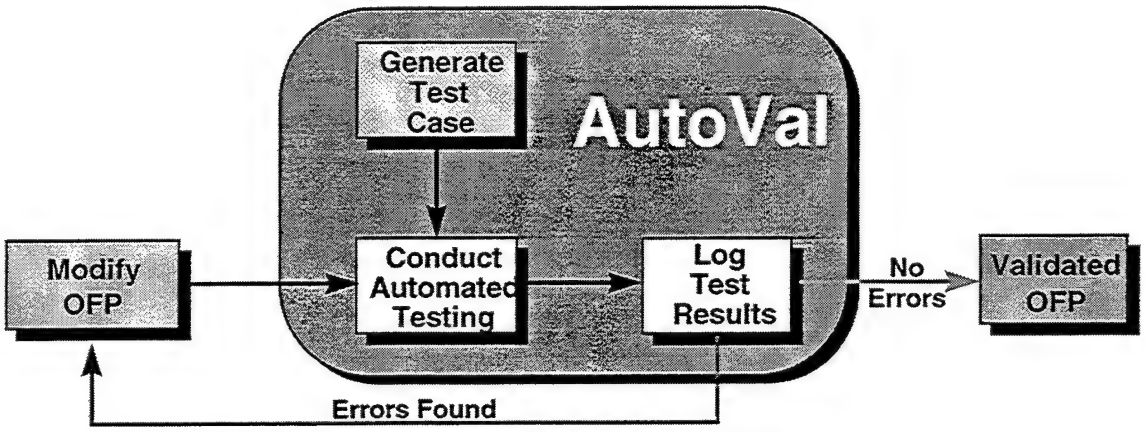


FIGURE 3. OFP TESTING WITH AUTOVAL

With the inclusion of AutoVal in the testing process, we have introduced a powerful and cost-effective tool to automate the verification of the OFP. The one aspect of the OFP testing process that AutoVal does not address is the generation of the FQT itself. This aspect of the testing process still requires a significant amount of manual effort. The effort is expended primarily designing the appropriate test sequences to assure that full test coverage has been achieved, and then generating the AutoVal code to implement those sequences.

Traditionally, testing strategies have been categorized as either structural or behavioral in nature. Structural testing, also called "glass-box" or "white-box" testing, is performed with the tester

having complete access to the source code. This approach allows the tester to ensure that every statement is executed, that conditional checks are performed, and so forth within the system under test. Behavioral testing, also called "black-box" or "functional" testing, is based on knowledge of the requirements of the system under test, without requiring any knowledge of the internal workings of the system. This approach allows the tester to concentrate on ensuring that all of the functional requirements of the system are tested without being influenced by the details of the system implementation. Often, a hybrid test strategy combines unit-level testing performed using the "white-box" approach with higher system-level testing performed using the "black-box" approach. The FQT test process in use today for avionics OFP testing primarily utilizes the black-box approach.

3.4 Automated Test Case Generation.

The efficiency of software testing using the black-box approach is being further extended by the development of modern fourth-generation, visually programmed testing tools that produce human- and machine-readable models for a system under test. Using this class of tool, test engineers are able to operate at a higher level of abstraction (only the system's behavior is relevant), focus on the test goals and strategy, and delegate the generation of the actual tests to an automated tool. One such tool on the market today is TestMaster™, a tool developed by Teradyne Software & Systems Test. TestMaster™ is an automatic test program generator that is composed of three major elements: a graphical editing tool, a test program generator, and a debugger (see Figure 4).

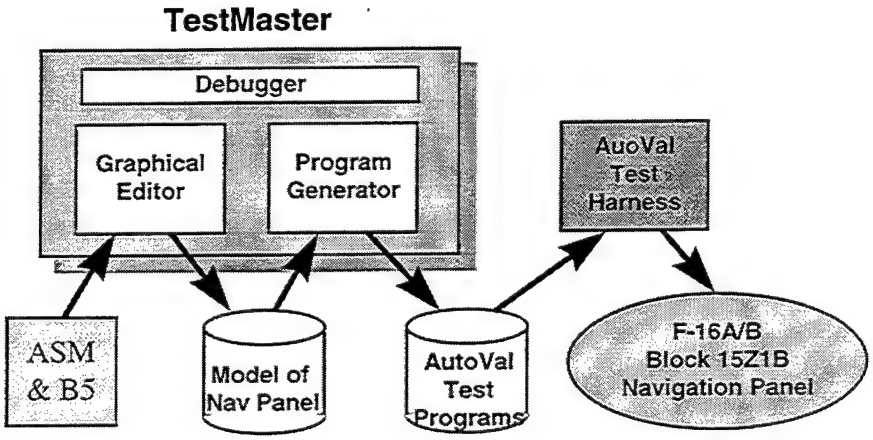


FIGURE 4. TESTMASTER™/AUTOVAL PROCESS

The TestMaster™ process first requires the construction of a model of the system under test. The engineer constructs this model with TestMaster™'s graphical editing tools while referring to

a specification of the system, such as a Computer Program Development Specification (CPDS), and an Avionics System Manual (ASM), in the case of avionics testing. Following construction of this model, the test engineer then uses the test generator to create a set of tests in the language of the target test harness (e.g., the AutoVal Command Language).

TestMaster™'s Model Reference Technology (MRT) is based on Extended Finite State Machines (EFSMs). There are two classical problems in using model-based techniques to generate test programs. The first of these is the problem of "state explosion". The second is that model-based test generation tends to generate far too many tests for practical use, even in a highly automated test execution environment. TestMaster™ overcomes these classical limitations with two exclusive features called, "Predicates" and "Constraints". Consider the following diagram (Figure 5), which shows the major elements of a TestMaster™ model: the states and the transition edge that connects states together.

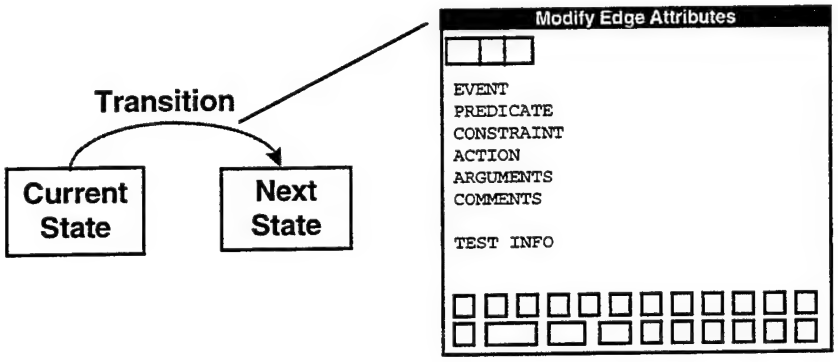


FIGURE 5. TESTMASTER™ MODEL AND PROGRAMMABLE ELEMENTS

Each transition edge in a TestMaster™ model of a system under test includes a variety of elements that are programmable by the user. Two of these elements are the predicate and constraint mentioned above.

The predicate is a boolean condition that must be true in order for the transition edge to be a legal path in the behavioral model. The predicate checks the context of a model, unlike a traditional state machine that has no historical context. The operational benefit of the predicate is that it prevents the classical "state explosion" problem and represents the "extension" in the TestMaster™'s extended finite state model. The predicate information is an integral part of the model specification of the system under test. (For example, take a situation where the "XYZ" missile requires targeting information. A predicate would be defined that states if an "XYZ" missile is mounted on the aircraft, then it is okay to add the targeting information.)

The constraint feature stands in contrast to the predicate, as the constraint is *not* part of the specification of the system under test. Rather, the constraint's function is to provide the model builder with a convenient and powerful tool to "constrain" the model so that it generates only a limited number of high economic value tests for application by the test harness. These two

features taken together — the predicate and the constraint — provide the underlying technology that make TestMaster™ a viable way to solve the automatic test generation problem.

Another key piece of information that is programmed into the edge attributes box is test-script command information for the target test harness (i.e., AutoVal). The model builder types into the Test Info line the exact test harness syntax required for the test harness to drive the system under test from the current state to the next state and verify correctness. When model construction is finished, the model serves as an input to the test generator (Figure 6).

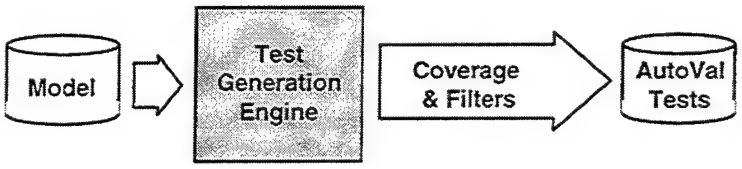


FIGURE 6. TESTMASTER™'S TEST GENERATION ENGINE

Under user control, the Test Generation Engine generates a set of tests in the language of the target test harness (i.e., the AutoVal Command Language). The user can set different coverage levels: for example, transition cover or full cover on a model by model basis. When the Test Generation Engine is set to transition cover, it finds a minimal number of tests required to make sure that each input is tested at least once (all transitions in the state model are traversed at least once). In contrast, when set to full cover, the Engine finds tests for all inputs, to all states, in all contexts — a set of tests that represent every possible path through the model. There are even coverage schemes that optimize, whereby the user can request full cover within a maximum selectable limit. In addition, there are "filter" capabilities that permit the user to ask the Test Generation Engine to provide only tests that meet certain criteria, for example, all tests that have something to do with a new product feature. These very powerful capabilities and characteristics ensure that the user can generate tests having the maximum economic value within the test execution time budget available. The practical result of this is that the user can generate tests for specific purposes, such as regression testing, overnight build testing, bug detection, etc. (Note: Useful tests can also be generated from a partial model. One does not have to wait for a complete model of the system under test before generating useful test scripts that can be applied by the test harness. In this regard, TestMaster™ supports an incremental and continuous improvement process of model building.)

3.5 Pilot Program Approach.

The research team selected the F-16A/B Block 15Z1B navigation data entry function as the primary avionics function to be modeled in the pilot program. Modeling this function permitted the team to investigate and develop the key test strategies needed to expand this technology to support the larger scale testing of complete avionics systems. Significantly, the navigation function is relatively complex, utilizing 24 buttons, two 12-position knobs, and a 16-position thumbwheel, all accessed by the test engineer through the Fire Control Navigation Panel (FCNP).

In addition, the navigation function performs a central role in the generation of complete mission scenarios.

3.5.1 Avionics Modeling Strategy.

Initially, we concentrated on developing a pilot program model that would exercise FCNP controls in every possible combination. This approach would exhaustively test the panel in both positive and negative test cases, overcoming the lack of negative case testing in the traditional approach, which we felt was a deficiency.

In order to model the FCNP function, we reviewed the F-16A/B Block 15Z1B ASM and the CPDS documents for the OFP's FCNP subsystem to determine its functionality. We also reviewed the existing F-16A/B AutoVal macros currently used for F-16A/B OFP testing. These reviews provided the preparation necessary to continue with our initial modeling attempt.

As we expanded our development of the FCNP model, the number of test paths that were generated soon grew to a number (over 5000) which would be impossible to execute in a reasonable period of time. In the FCNP data entry system model, we found many instances where more than one system function could be activated at the same time with no operational restriction of the sequence in which functions were activated. Left unconstrained, the model generated large numbers of test paths in these circumstances.

Such large sets of tests are generally not necessary for a comprehensive test, since many of the tests generated under these conditions have no value in testing a specific system requirement. For instance, tests that set the thumbwheel position prior to setting the function knob have no value, since the thumbwheel position has no meaning unless the function knob is in the appropriate position. Therefore, we developed constraint strategies to enforce system functional details and limit the overall number of tests generated, while attempting to continue generating thorough, high-quality tests.

Another issue soon became apparent. While the model could generate a set of exhaustive tests for the FCNP, a model design focused solely on FCNP functionality could not be used effectively to implement the broader objective of mission-scenario-based testing. In order to create a complete mission-based test, the FCNP models must have the perspective of, or visibility into, the overall test objectives. For example, an exhaustive model for the waypoint entry function that generates random waypoints cannot easily be tailored to provide realistic mission data sets (e.g., a set of mission waypoints arranged in an "orderly" progression along a flight route that are all located within the combat radius of the aircraft). While millions of tests could be generated by stringing together multiple exhaustive panel models, only a very small subset of the tests generated would be usable. After discussing this obstacle among the research team members, we elected to modify our modeling approach.

In our revised modeling approach, we developed a hierarchical model of the system (Figure 7). The highest level of this hierarchy provides a "test profile function" allowing the test engineer to define the mission scenario and system functions to be tested. The top-level model is a high-level abstraction of the mission scenario. At the intermediate level, the model reflects the high-level operational tasks, such as navigation, air-to-air combat, etc., as described in the ASM. The bottom-level of the model details the individual steps, such as pressing a button, turning a knob, or toggling a switch, that are necessary to perform tasks defined at the intermediate level. This level also incorporates AutoVal by including AutoVal command strings as the model output. In this revised approach, the higher levels of the model provide a test case framework that is scenario/system-function-oriented, while relying on the lower levels of the model to generate test scripts that actually stimulate and verify the OFP under test.

During the pilot program, we created a model hierarchy for the complete F-16A/B avionics suite, but only partially populated it with detailed function and subsystem models. We populated the remainder of the hierarchy with model "shells" that served as placeholders for possible future expansion. In formulating the details of the hierarchy and deciding how to partition the functions within levels and among levels, the research team purposely defined a structure that was as generic as possible for the general avionics testing domain at the intermediate and top levels. Instead of producing upper-level models that are tightly coupled to F-16 testing, we specifically created a framework and models that are reusable for many avionics testing applications. The TestMaster™ tool lends itself very well to this type of progressive development and to broad component reuse.

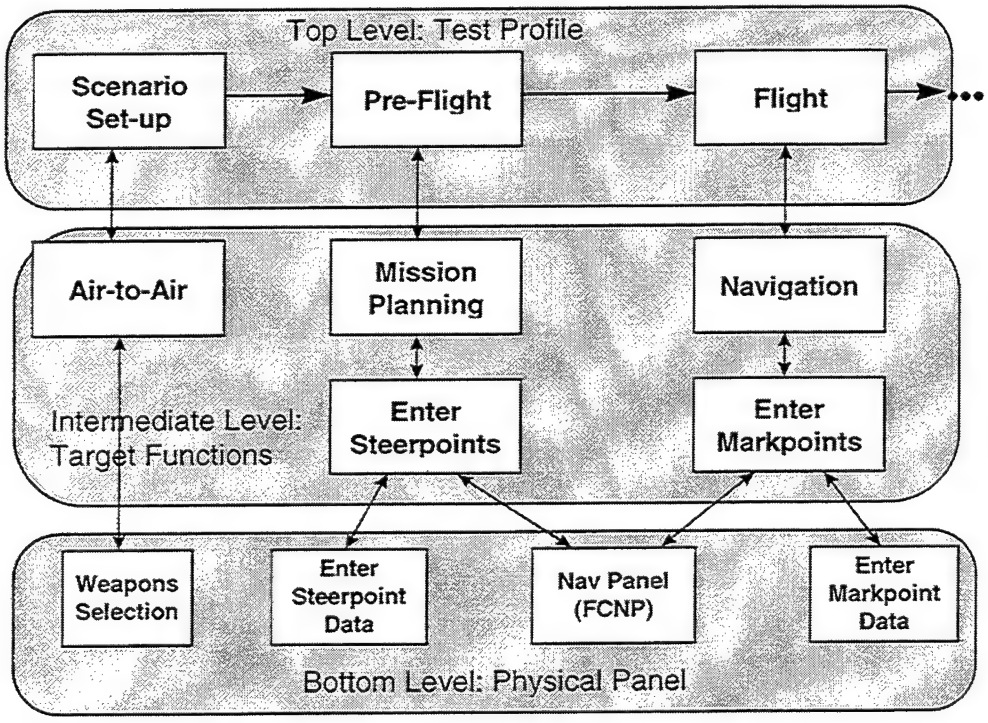


FIGURE 7. MODELING HIERARCHY

The final component of the revised modeling strategy was one additional type of model structure we called a "variable declaration" model. The variable declaration model provided a mechanism for declaring the numerous scalar variables required for mission planning data entry. These scalars are needed because TestMaster™ does not currently support array variables and also limits the number of variables that can be declared in each model. This limitation required us to organize the variables into smaller groups among the various models. Although this organization process provided a feasible solution to the problem and improved variable utilization, it forced the creation of extraneous models having no purpose other than variable declaration. The implementation of variable arrays and structures in the next version of TestMaster™ will greatly reduce the number of variable declarations required and increase the manageability of variable usage, as well as eliminate the need for this artificial model structure.

A detailed list of mission scenarios developed during the pilot program and the functional descriptions of each TestMaster™ model used to implement the scenarios appear in Appendix C.

3.5.1.1 Top-Level Models.

The top level of the pilot program model defines the basic test profile and sequence (see Figure 8). This top-level of the hierarchy is created by the modeler and determines the basic test strategy: unit versus system. During system testing (e.g., an FQT), the components on this level set up a scenario and then sequence through its phases (i.e., preflight, takeoff, etc.). These top-level components set data values that control the output of the model and specify its purpose. The components called "VTS_Setup" and "VTS_Cleanup" involve pre-test and post-test actions, respectively, which are associated with the avionics test station responsible for automated execution of the tests.

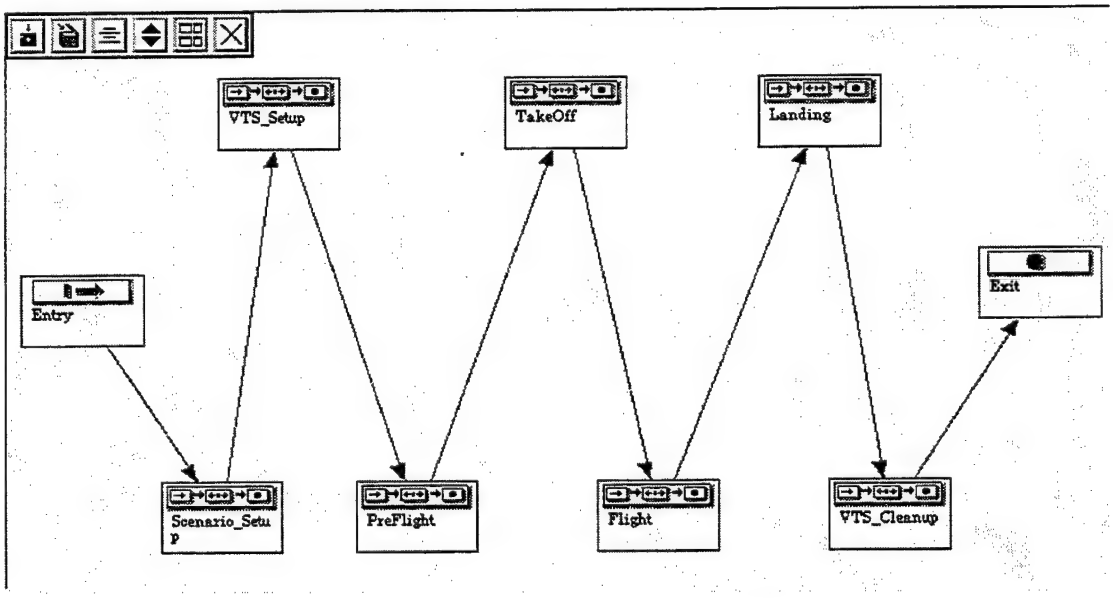


FIGURE 8. TEST PROFILE MODEL

Another key model within the high-level model group is the scenario setup model. We have designed this model to serve as a repository for all the information needed during scenarios to implement a complete mission. The scenario setup model includes directives regarding what type of scenario test is to be generated, along with the information (navigation, stores, etc.) necessary to develop the appropriate tests.

3.5.1.2 Intermediate-Level Models.

The intermediate level of the hierarchy represents the operational tasks that combine to produce the components of the high-level model. In general, they are made up of tasks, such as mission planning, that are described in the ASM. As an example, Figure 9 illustrates the intermediate-level models that make up the PreFlight high-level component.

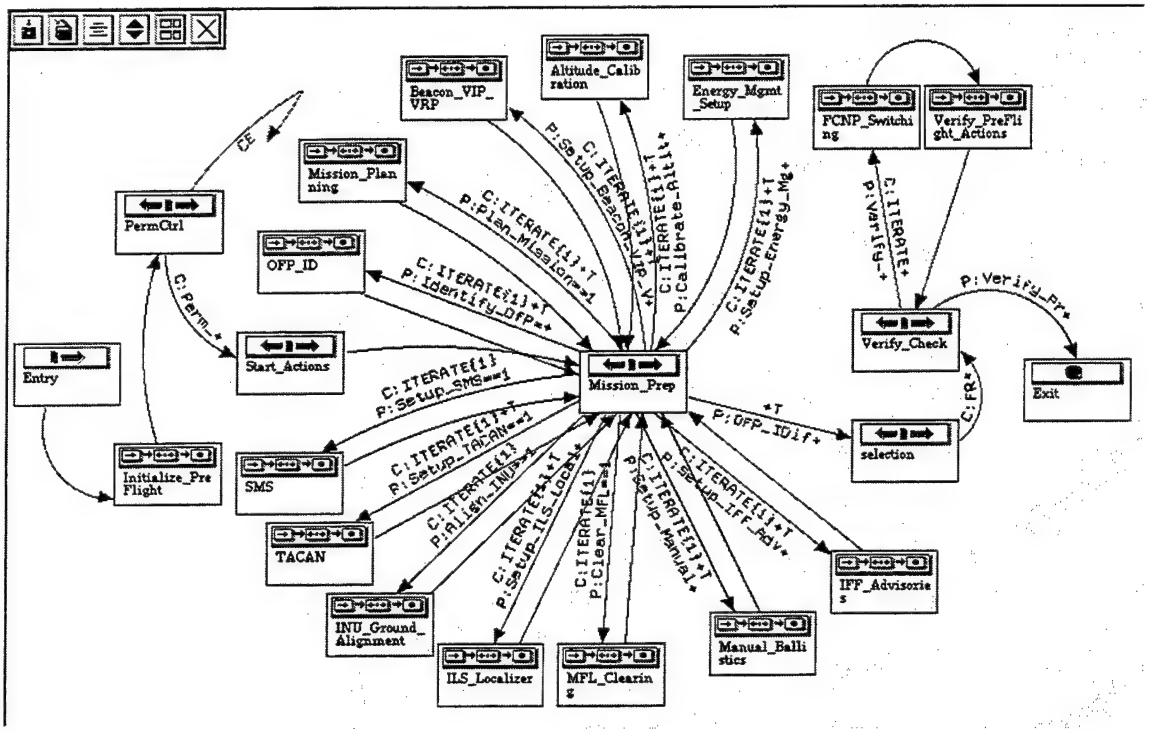


FIGURE 9. PREFLIGHT FUNCTION MODEL

These PreFlight task models call component function models (as shown in Figure 10) that actually accomplish the Nav_Panel (FCNP) functions. While the task models call these Nav_Panel (FCNP) functions, parameters are passed that have the effect of "constraining" the model in order to achieve the target test goals in terms of both coverage and number of tests.

The PreFlight model offers a good illustration of another type of the constraint strategy used during the pilot program. There are nine preflight functions that can be activated in the PreFlight model. Since these functions may be performed in multiple group combinations having any sequence within each group, almost one million possible test paths exist. The multiple group combinations do not provide beneficial test cases, however, because not all groups include all of the required functions. We therefore added a constraint strategy to the exit transition of the PreFlight model to allow only test paths that include all of the requested preflight functions to be accepted. This constraint strategy not only forced all the desired functions to be activated, but also reduces the number of tests generated from nearly one million to 362,880. Although this was a dramatic reduction, the total number of generated tests was still unmanageable.

Next, we implemented a constraint to allow the test engineer to impose a limit on the number of test paths generated through the PreFlight model by setting an iteration variable. As long as the test engineer chose an interation value less than 362,880, each test path taken through the model traversed a different sequence of events each time. This behavior provided the test engineer with the flexibility to test as many different sequences as time and budget permitted.

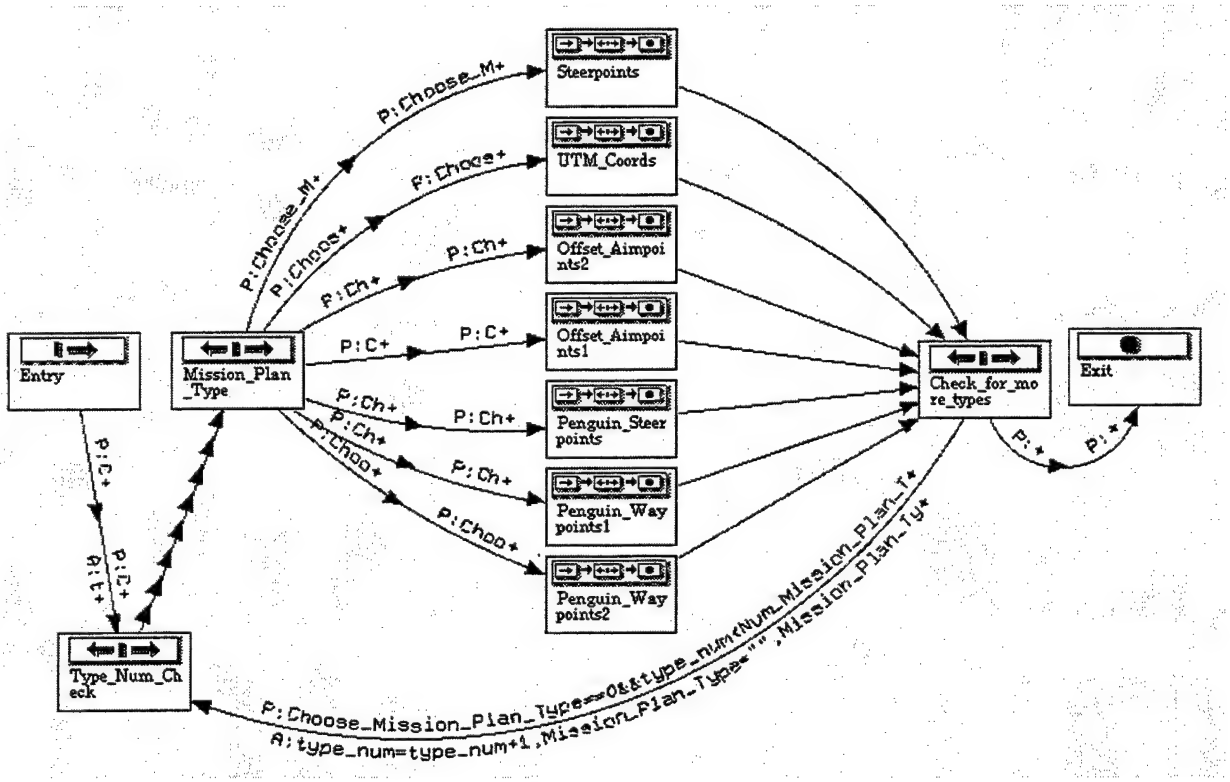


FIGURE 10. MISSION_PLANNING MODEL

3.5.1.3 Bottom-Level Models.

The bottom level of the hierarchy includes models (as shown in Figure 11) that describe the physical operation necessary to drive the target functions in the test. For example, in order to enter a steerpoint, the Nav_Panel (i.e., the FCNP) model sets the knobs, buttons and switches to the proper settings. Subsequent to this, another model enters and verifies the steerpoint data.

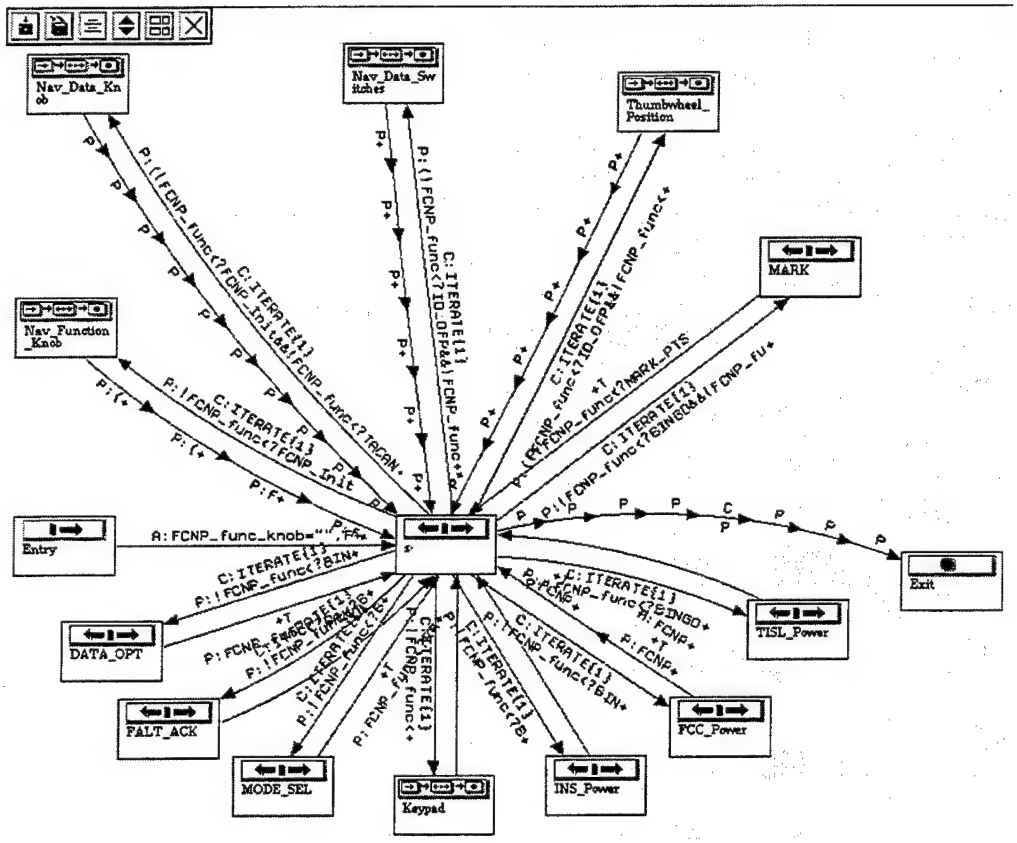


FIGURE 11. NAV_PANEL (FCNP) MODEL

The Nav_Panel (FCNP) model illustrated in Figure 11 is an example of a bottom-level model. One or more of the objects (knobs, switches, thumbwheel) on the Nav_Panel (FCNP) are manipulated depending on the desired function or scenario. For the specific test of entering a steerpoint for a mission scenario, a parameter is passed to specify which function is being tested. This method produces a reduced number of tests. The higher level models further reduce the combinations tested depending on the purpose of the test profile (i.e., unit or system). Very little filtering is done for unit testing. In the case of system (or scenario) testing, combinations of characteristics are specified, and this in turn greatly reduces the number of paths followed to perform the function.

4.0 RESULTS

4.1 Test Strategy Observations and Results.

During our functional modeling activity, we discovered that the ASM and CPDS documents did not provide enough detail to accurately model some functions of the Nav_Panel (FCNP). In some cases, we had to exercise the actual OFP on the XFCC within the dynamic test station to clarify specific functions before modeling them. These observations suggest that the ASM and CPDS alone may not always provide an unambiguous requirement reference for the OFP developer. While the members of OFP development teams in the past were generally located together and able to quickly resolve these types of ambiguities, future systems, which will grow in size and complexity, may no longer permit the synergy that is fostered by the centralization of development team members. Incomplete and/or conflicting requirement specifications have been found to be a primary driver of cost and schedule overruns on many development efforts. An alternative method of creating unambiguous specifications of system behavior is the use of state machine notation. Since TestMaster™ uses EFSMs to model the system for testing, then, in addition to generating "black box" tests, TestMaster™ could potentially also be used to actually define the software requirements specifications (indeed, the telecommunications industry uses EFSM notation such as SDL to specify products). This use would have the added benefit of reducing the number of system defects caused by incomplete and/or conflicting specifications.

The layered modeling approach, as discussed in the previous sections, appears to be an equitable compromise between the conflicting goals of a totally exhaustive test and a representative scenario for validating functionality over an entire mission. As noted below in the TestMaster™ tools observations section, if TestMaster™ had the ability to associate different constraint sets with the same EFSM diagrams, it would further reduce the effort needed to generate models to perform both scenario and exhaustive testing.

The use of the panel models allows the test engineer to easily create new scenarios without being knowledgeable of the AutoVal command language and/or the underlying dynamic test station implementation. However, adding or changing functionality of a panel model would require that the test engineer be proficient in the use of AutoVal and knowledgeable of the underlying test station capabilities.

The tool is capable of generating thousands of tests for validating the OFP under test. The challenge of using TestMaster™ is in applying constraints that reduce the number of tests to a meaningful set, executable within the given time and budget limitations.

A review of the code generated during this pilot program (provided in Appendix D) shows that a TestMaster™ model can be tailored to produce a wide range of test coverage extending from the coverage of current, manually created FQTs up to the very exhaustive coverage needed for unit testing (see Appendix A). In the pilot program model, we specifically limited the number of navigation data entry points in sample scenarios so as to address other issues more thoroughly.

A large number of variables would have been required to define all the waypoints in the complete F-16A/B FQT.

Some minor postprocessing was required to make the TestMaster™ generated code compatible with AutoVal. TestMaster™, within the limitations defined by predicates and constraints, generates code for each path in a model. It identifies the code for each path by enclosing it in braces ({}) and preceding it with a unique path identifier (i.e., path1()). The path identifier and braces are incompatible with the AutoVal syntax and must be removed prior to executing the code in the AutoVal environment. Due to the relatively low number of paths generated for the pilot program, the postprocessing was performed manually. For cases involving larger number of paths, the postprocessing can be easily automated using a commonly available scripting language such as Perl.

4.2 TestMaster™ Observations and Results.

Our overall impression of TestMaster™ is that it is a very capable tool. Through the course of this pilot program, we identified a number of candidate modifications to TestMaster™ that would further improve its utility with respect to large avionics testing applications.* These include:

User Interface:

- Develop a capability to manually route event arrows to improve the layout of the EFSM. An ability to place "handles" at regular intervals on an event and to route the arrows would be helpful.
- Provide an annotation scheme that permits clearer understanding of the names of states and the information associated with transition.
- Provide a full-featured print capability.
- Allow models to be renamed.
- Provide the ability to cut, paste, and copy text and graphical objects.
- Provide an auto-scrolling feature for use when entering test information on the Edit Transition Windows.

Model Development:

- Provide the ability to save a read-only model version that still has full constraint editing, so a modeling/development engineer can generate the detailed functional model and a test engineer can generate various types of tests without changing the model functionality.
- Provide the capability to allow more than one person to work simultaneously on the same set of interrelated models.

* Note: At the time of this report date, Teradyne described an engineering plan that includes most of these extensions in release 1.7 of TestMaster™.

- Provide the capability to save a set of constraints separate from the model, so that multiple constraint sets can be saved and recalled in order to generate different types and numbers of tests.
- Provide array variable and record structure capabilities.
- Improve the speed and performance of the debugger.

In addition to generating tests, the modeling features of TestMaster™ may be used for defining specifications. Although it was outside the scope of this study, we did observe that the requirements definition/specification process for large OFPs might benefit greatly from the use of TestMaster™ EFSMs as formal specifications. As an integrated element of the OFP software engineering process, the same model used for requirements specification could then be used to automatically generate the test cases needed to test the OFP to those requirements.

4.3 Pilot Program Coverage Analysis.

To formulate conclusions and extrapolate an estimate for the effort needed to model an entire OFP, we considered several factors. The first factor was a method of quantifying the number and complexity of F-16A/B Block 15Z1B OFP functions. We began by identifying the primary systems and panels that comprise the F-16A/B avionics system.

The F-16A/B Block15Z1B avionics system consists of the following main subsystems:

- Fire Control Computer (FCC)
- Fire Control Radar (FCR)
- Inertial Navigation System (INS)
- Head-Up Display System (HUD)
- Radar Electro-Optical Display System (REO)
- Data Transfer Equipment (DTE)
- Combined Altitude Radar Altimeter (CARA)
- Central Air Data Computer (CADC)
- Advanced Identification Friend or Foe (AIFF)
- Stores Management System (SMS)

The test engineer controls these subsystems through the following Pilot-Vehicle Interface (PVI) hardware:

- Fire Control Navigation Panel (FCNP)
- Stores Control Panel (SCP)
- HUD Control Panel (HCP)
- AIFF Control Panel (AIFF)
- Radar Control Panel (RCP)
- Instrument Mode Select Panel (INSTR)
- Nuclear Consent Panel (NCP)
- Sensor Control Panel (right console)

- Left auxiliary console
- Throttle Grip
- Side Stick Controller (SSC)

The following table (Table 1) lists the number of knobs, switches, and push buttons on each panel to quantify the relative complexity of the panels.

TABLE 1. SUMMARY OF CONTROLS BY PANEL ON F-16A/B BLOCK 15Z1B

	Discrete Knobs		Analog Knobs	Push buttons	Switches		Thumb wheel	
	No.	Total Positions	No.	No.	No.	Total Positions	No.	Total Positions
FCNP	2	24		24			1	16
Stores Control Panel			1	19				
HUD Control Panel	1	15	4		7	20		
Radar Control Panel	4	20			3	9		
AIFF Control Panel	2	8			6	13		
Throttle Grip	1				3	7		
Side Stick Controller				2	2			
Instr. Mode Select Panel	1	4	1					
Nuclear Consent Panel					2	6		
Sensor Control Panel								

While this data suggests that the FCNP is one of the more complicated panels in the aircraft, it is difficult to infer relevant information from this table alone, because the number of controls on a given panel does not give much information about the quantity and complexity of functions that are accomplished when those controls are used together as a subsystem.

We felt that a more accurate metric would be a calculation of the number of pages from the ASM (Table 2) that we modeled during this pilot program compared to the total pages (Table 3) contained in the complete manual. The following tables (Avionics Systems Manual sections

modeled and remaining) list the number of pages allocated to the various procedures and functions specified in the F-16A/B ASM. These numbers give a fair representation of the relative complexity of the avionics systems procedures, since more pages are required to describe

TABLE 2. AVIONIC SYSTEMS MANUAL PAGES MODELED

Avionic Systems Manual sections modeled	Number of Pages
3.1 Mission Preparation Intro	3
3.2.1 - 3.2.2 OFP Identification of FCC and AIFF	2
3.4.1 - 3.4.2 Manual Entry of Mission Planning Table	9
3.6.1 Automatic D-Value Calibration	1
3.8.1 Bingo Fuel Entry	2
3.10.2.1 MSL ALO Entry	1
3.10.3.1 AGL ALO Entry	1
3.11.2 IFF Advisory	2
4.3.4 Bingo Fuel Warning	3
4.4.4.3 ILS Flight Director Selected	1
5.3.4 TACAN Position Fixtaking	3
5.4 Markpoints	3
7.2.3.1.1 VIP Data Entry	2
7.3.1.1.1 VRP Data Entry	2
7.3.3.1.1 BEACON Data Entry	2
7.4.1.1.1 Manual Ballistics Entry	1
7.5.1 Penguin Mode Data Entry	2
Total:	40

TABLE 3. AVIONIC SYSTEMS MANUAL PAGES REMAINING TO BE MODELED

Avionic Systems Manual sections remaining	Number of Pages
Section 3 General Operating Procedures	91
Section 4 Navigation	59
Section 5 Fixtaking	27
Section 6 Air-To-Air Combat	113
Section 7 Air-To-Ground Attack	165
Section 8 Malfunction Analysis	153
Section 9 Backup Mode Operation	9
Total:	617

more complex functions. Following this assumption, an estimate can be made of the percentage of the overall system that was modeled during this pilot program.

Based on this information, we estimate that we completed 6.1% of the modeling needed to complete a TestMaster™ model of the entire system.

Percent Complete = 40 pages of procedural specifications modeled
/ 657 total pages of procedural specifications = 6.1%

4.4 Full-Scale Program Projection.

We summarized the labor hour effort we expended to complete the pilot program model and projected from this pilot activity the effort required for a full-scale OFP development. This log of actual hours and projected effort is presented in Table 4.

TABLE 4. LABOR EFFORT ANALYSIS

Activity	Pilot Program Metrics	Projections for Full Scale OFP		
	Prototype for 6.1% of OFP	Training & Learning Curve	Prototype for Full OFP	Formal Test Development for Full OFP
Learning Black Box Testing	40	0	0	0
Learning TestMaster™ Tool	80	0	0	0
System Functional Analysis	72	72	1,180	3,540
Develop Model Strategy	92	23	377	1,131
Modeling	152	76	1,245	3,735
Test Profile	12			
Target Functions	60			
Physical Panel	80			
Testing Scripts on the VTS	60	60	984	2,952
Total Hours	496	231	3,786	11,358
Person-years @ 1,824 hrs			2.08	6.23

The actual effort expended during the pilot is indicated in the first column (these times are in hours). In order to project the effort required for a formal test program development for the full OFP, we need to make several adjustments. The assumptions underlying the projections for a full scale OFP test program are as follows:

Modeling & Tool Training. Since this is the first time that TestMaster™ was applied by SAIC personnel, it is necessary to adjust for the time to learn the concepts of modeling and the use of the TestMaster™ tool. In this case the reader will observe that the learning time associated with both the issues of black-box testing and the TestMaster™ tool are factored out. Furthermore,

considerable time was spent up-front considering alternative model strategies that would yield the overall desired results. We believe that on subsequent projects only a quarter of this time would be required, given the body of knowledge that has now been built up. Therefore, we assumed that the 92 hours required to develop a model strategy would drop to 23 hours.

PFL Extension & Modeling Learning Curve. In addition to the effect of fundamental training, column two includes the expected effect that would result from the suggested PFL extensions and the learning curve effect gained in modeling. It is expected that the combination of these two effects would reduce the modeling effort required by a factor or 50%, reducing the overall modeling time required from 152 hours to 76 hours.

Full Scale OFP. The pilot activity which is the subject of this study encompassed a subset of a full OFP. While it is admittedly difficult to project how much additional effort would be required to model a full OFP, it is reasonable to make some assumptions and build the scaling factor accordingly. After considering several alternatives, it was decided the best available scaling factor could be derived per the discussion in the previous section. Based on the number of pages in the ASM, it suggests that the pilot activity comprised 6.1% of the full OFP. The third column reflects the adjustment to progress from development of a partial OFP test program to one for the full-scale OFP.

Formal Development. Finally, it should be recognized that this pilot program activity was a rapid prototyping endeavor. In any such rapid prototyping activity there will be shortcuts and abbreviated activities that would not be acceptable in a formal development effort. Based on previous experience, a formal development effort typically takes three times as long as a rapid prototyping of the same project. Therefore, the final column of this table represents the adjustments one might expect to make in the case where this technique is deployed in a formal OFP test program development effort.

These estimates are for the engineering hours only, and do not include associated labor, such as program management, Quality Assurance, Configuration Management, etc.

4.5 Lifecycle Cost Projections.

The initial, up front development time of a formal qualification test for an OFP with the same approximate size and complexity as the one used for this pilot program is on the order of 12 person-years (144 person-months). It is tempting to compare this effort with the projected time for development of a full OFP test program using TestMaster™ and AutoVal (6.23 person-years or 75 person-months) and simply note the initial cost savings. There are, however, broader lifecycle issues associated with the comparison between a conventional manual OFP testing process and a fully automated OFP test generation and execution process. At the conclusion of a 12 person-year traditional FQT preparation activity, you have a document that must be either applied to manual testing of the OFP or converted to an automated test language for automated testing. Manual OFP testing using a conventional FQT requires two to three test engineers for a typical period of three to six weeks depending on the FQT size and OFP complexity. In other words, for each manual application of the FQT, anywhere from six person-weeks to 18 person-weeks of effort is expended. This recurring cost for manual FQT application can be significantly

reduced through automated test execution with a tool such as AutoVal. (We have measured a 100-to-1 time compression for F-16 OFP testing with AutoVal compared to manual FQT execution.) However, our experience with F-16 has shown that the effort required to convert an FQT to the AutoVal command language (about eight person-years) is only marginally less than the 12 person-year effort required to generate the original FQT.

In contrast, at the conclusion of a 6.23 person-year TestMaster™-based test program development effort, you have both a model of the system under test and a complete set of test scripts ready for automated regression testing of the OFP using AutoVal.

A brief lifecycle cost comparison between the two methods -- the traditional manual FQT approach and the automated TestMaster™/AutoVal approach -- will yield insight into the overall economic advantage of complete OFP test automation.

Assume the following:

- Initial FQT generation is a 144 person-month effort
- Application of each FQT test cycle averages 12 person-weeks (3 person-months)
- The weapon system has 20-year deployment life
- There are 56 total OFP update cycles over the system life (an average of four per year for the first 12 years and one per year in final eight years
- Initial generation of the TestMaster™ model and the AutoVal tests is 75 person-months
- Each update cycle, on average, affects 10% of the system

Traditional FQT Lifecycle Costs.

The total OFP testing effort in person-months over the weapon system lifecycle utilizing a traditional manual approach for test generation and execution will be:

Total Lifecycle Testing Effort = Initial FQT Development Effort
+ Number of Updates * (FQT Update Effort + FQT Execution Effort)

where,

FQT Update Effort = Initial FQT Development Effort
* Average Percent OFP Change Per Update

The following chart shows the results of applying this relationship based on the assumptions stated above.

	Initial FQT Development (Person-Months)	Updates	Change Per Update (Percent)	FQT Update - Each (Person-Months)	Manual FQT Execution (Person-Months)	Total Lifecycle Testing Effort (Person-Months)	Cost @ $10K Per Person-Month ($)
Traditional Manual Test	144	56	10%	14.4	3	1118	$11,184,000

TestMaster™/AutoVal Lifecycle Costs.

The total OFP testing effort in person-months over the weapon system lifecycle utilizing a fully automated approach with TestMaster™ for test generation and with AutoVal for test execution will be:

Total Lifecycle Testing Effort = Initial Test Development Effort
+ Number of Updates * (TestMaster™ Model Update Effort + Automatic Test Effort)

where,

TestMaster™ Model Update Effort = Initial Test Development Effort
* Average Percent OFP Change Per Update

and,

Automatic Test Effort = 2 person-weeks for test setup and
for post-test assessment of results

The following chart shows the results of applying this relationship based on the assumptions stated above.

	Initial Test Development (Person-Months)	Updates	Change Per Update (Percent)	TM Model Update - Each (Person-Months)	Automatic Test Execution (Person-Months)	Total Lifecycle Effort (Person-Months)	Cost @ $10K Per Person-Month ($)
Fully Automated Test	75	56	10%	7.5	0.5	521	$5,214,160

The difference between the current manual FQT approach and the automated test generation and test execution with TestMaster™ and AutoVal suggest a savings of 597 person-months, or almost $6 million at a burdened labor rate of $10K/engineer per month. This simple analysis suggests that there are, indeed, some large potential economic advantages in applying a fully automated test generation/test execution solution to the problem of testing OFPs.

THIS PAGE INTENTIONALLY LEFT BLANK

5.0 CONCLUSIONS.

AutoVal/TestMaster™ Integration. TestMaster™ integrated extremely well with AutoVal. The tests generated by TestMaster™ were postprocessed in order to remove TestMaster™ path identification information from the tests, which then ran directly in the AutoVal environment. TestMaster™ generated tests that seamlessly integrated into the AutoVal environment through this postprocessing step.

Absolute Implementation Cost. The cost to implement TestMaster™ for OFP testing is projected to be on the order of 6 person-years. This projection is based on the actual labor required for this rapid prototype pilot project and is adjusted for a full-scale OFP testing application done under the rigor of formal development processes.

Comparative Implementation Cost. TestMaster™ projects to have a favorable cost advantage over the current FQT approach. This is true for both the initial FQT development effort, as well as the lifecyle costs associated with the two approaches. For the initial effort TestMaster™ is approximately 50% faster: 6 person-years versus 12 person-years. On a lifecycle basis, TestMaster™/AutoVal costs project to 43 person-years compared to 93 person-years for the current approach.

Test Quality. TestMaster™ can provide a significant quality advantage over the current process. This quality advantage is a direct result of TestMaster™'s ability to generate many different combinations of test sequences, including both positive and negative test cases -- something that is lacking in conventional FQTs. Furthermore, a larger number of TestMaster™ tests can be conveniently executed in the same or less time than the current approach because of the automated test execution environment provided by AutoVal.

Defined Process for Developing Tests. Current manual test development methods rely more on the skill, forethought, and experience of the individual test engineers. The TestMaster™ tool enables a more structured and well defined engineering process to be used. The rigorous EFSM modeling approach helps to reduce human error and produce more thorough tests. Also, the use of a defined process permits test engineers of more widely varying experience levels to consistently produce higher quality tests.

Ancillary TestMaster™ Benefits. There are two additional areas of value that could result from development of TestMaster™ models for the system under test. One such area is that the models could be used to serve as part of the functional specification of the system. In this pilot project the TestMaster™ model integrated information from both the B5 and the ASM, which helped to clarify some of the ambiguities. For new avionics systems the TestMaster™ model could be used to define the requirements of the new system. This same model could subsequently be reused to generate the tests needed for formal qualification testing to confirm that the delivered system meets those requirements.

Areas for Future Consideration. The pilot project also revealed areas of possible future investigation that may yield additional advantages. These include:

- Support for multiple test stations, where each test station has its own set of characteristics that "constrain" the types of automated tests that can be generated.
- Additional value could be realized if specifications, test station limits, and individual test scenarios could be managed from a central TestMaster™ model.
- Integration of AutoVal's language sensitive editor so that AutoVal commands and macros could be easily cut and pasted into TestMaster™.

The rapid advance of embedded systems and software is creating a strong need to upgrade the tools and techniques used for OFP engineering. With safety-of-flight issues in the balance, the cost in lives, mission success, and dollars is too high to permit anything except well tested OFPs to be fielded in operational systems. The increasing complexity of OFPs, coupled with declining funds available to the Air Force, make it imperative that newer, more efficient testing techniques be employed to reduce the manual, highly labor-intensive efforts currently associated with OFP testing. AutoVal technology combined with an automatic test-generation tool like TestMaster™ offers a viable, off-the-shelf solution immediately available to reduce OFP testing costs and to improve OFP quality.

6.0 NOTES

6.1 List of Acronyms.

AASH	Avionics Directorate, System Concepts and Simulation Division, Software/Hardware Technology Branch
AIFF	Advanced Identification Friend or Foe
AISF	Avionics Integration Support Facility
ASM	Avionics System Manual
AutoVal	Automated Validation
CADC	Central Air Data Computer
CARA	Combined Altitude Radar Altimeter
CPDS	Computer Program Development Specification
CSCI	Computer Software Configuration Item
DARTE	Distributed Ada Real-Time Executive
DOD	Department of Defense
DTE	Data Transfer Equipment
EAR	Export Administration Regulation
ECS	Embedded Computer System
EFSM	Extended Finite State Machine
ESIP	Embedded Computer Resources Support Improvement Program
FCC	Fire Control Computer
FCNP	Fire Control Navigation Panel
FCR	Fire Control Radar
FQT	Formal Qualification Test
GUI	Graphical User Interface
HCP	HUD Control Panel
HUD	Head-Up Display
INS	Inertial Navigation System
INSTR	Instrument Mode Select Panel
ITAR	International Traffic in Arms Regulation
MRT	Model Reference Technology
NCP	Nuclear Consent Panel
OFP	Operational Flight Program

RCP	Radar Control Panel
REO	Radar Electro-Optical
SCP	Stores Control Panel
SDL	Software Description Language
SIL	System Integration Laboratory
SMARTNet	Shared Memory Architecture Real-Time Network
SMS	Stores Management System
SPS	Software Product Specification
SRS	Software Requirements Specification
SSC	Side Stick Controller
VDD	Version Description Document
VTS	Virtual Test Station
WL	Wright Laboratory
XFCC	Expanded Fire Control Computer

Appendix A

10.0 F-16A/B BLOCK 15Z1B FORMAL QUALIFICATION TEST (FQT): FIRE CONTROL NAVIGATION PANEL (FCNP) MISSION ENTRY AND RETRIEVAL

THIS PAGE INTENTIONALLY LEFT BLANK

YES NO

FCNP MISSION ENTRY AND RETRIEVAL

TEST OBJECTIVES

1. Verify that the XFCC provides for the storage and accessing of location data for steerpoints, Mark points, UTM points, Penguin target/waypoints, and offset aimpoints via FCNP entry/display. (Reference 1, paragraphs 3.2.10.2 and 3.2.10.2.1)

TEST PROCEDURES

1. Initialize the Test Station with Test Case MISS and Command/IC File MISS.

2. Position the DATA knob to TEST and ensure that the MFL is cleared.

Steerpoint Data Entry

3. Position DATA knob to DEST, DIR AIM ON. For each entry in the following Table, set the thumbwheel and SPARE button to the indicated positions, DATA OPT to steerpoint number, enter the specified latitude (LMD) and longitude (RMD), DATA OPT to E/T and enter the steerpoint elevation (LMD) and Time-on-Target (RMD).

STEERPOINT DATA ENTRY					
TW #	SPARE SWITCH	LATITUDE LMD	LONGITUDE LMD	ELEV LMD	TOT RMD
0	OFF	N17°41.7′	W118°04.3′	+41	+102337
1	OFF	S45°54.8′	E102°22.5′	+13	+080706
2	OFF	N13°23.7′	W 43°14.7′	+323	+010410
3	OFF	S67°14.3′	W147°12.4′	+452	+023721
4	OFF	N13°54.9′	E 93°21.8′	+2374	+112135
5	OFF	S 8°12.3′	E100°11.7′	-782	+112511
6	OFF	S65°33.3′	W 91°31.8′	+1005	+032154
7	OFF	N18°21.0′	W121°31.8′	+331	+074536
8	OFF	N17°37.6′	W113°07.9′	+1199	+170054
9	OFF	N33°21.0′	E171°16.9′	+3912	+045009
0	ON	N39°23.9′	E 81°41.6′	-77	+180211
1	ON	S 0°21.8′	W109°27.9′	+12744	+100939
2	ON	N31°16.3′	E114°11.8′	+6341	+073000
3	ON	N24°47.2′	W 21°57.0′	+341	+212103
4	ON	N43°06.6′	E 4°26.5′	+1024	+101213
5	ON	S15°24.7′	E127°13.7′	+8149	+000000
6	ON	S31°44.4′	E 19°55.9′	-1500	+183112
7	ON	N 0°00.0′	W 0°00.0′	+80000	+235959
8	ON	S90°00.0′	E180°00.0′	+0	+120001
9	ON			+1	+235858

YES NO

STEERPOINT DATA ENTRY					
TW #	SPARE SWITCH	LATITUDE LMD	LONGITUDE LMD	ELEV LMD	TOT RMD
		N89°59.9′	W 1°01.0′		

Steerpoint Data (OAP1) Entry

4. Select OAP1. For each entry in the following Table, place the thumbwheel and SPARE switch in the indicated positions, DATA OPT to BR0/BR1, enter the specified OAP1 bearing (LMD) and range (RMD), DATA OPT to E/N and enter the appropriate elevation (LMD).

OAP1 DATA ENTRY				
TW #	SPARE SWITCH	BRNG LMD	RANGE RMD	ELEV LMD
0	OFF	+112.6	+8723	-333
1	OFF	+101.5	+9913	+1023
2	OFF	+32.7	+171	+512
3	OFF	+17.2	+2426	+1672
4	OFF	+289.4	+1567	+55
5	OFF	+351.5	+364	+1836
6	OFF	+109.7	+3476	-1007
7	OFF	+195.1	+1789	+571
8	OFF	+134.7	+7159	+1010
9	OFF	+18.7	+4741	+23780
0	ON	+156.3	+906	+11656
1	ON	+321.6	+8742	+6733
2	ON	+307.6	+57812	+75290
3	ON	+93.3	+122	-178
4	ON	+289.4	+12367	+37198
5	ON	+241.7	+8734	+2275
6	ON	+146.8	+31	+21356
7	ON	+77.8	+1732	+1299
8	ON	+359.9	+0	+80000
9	ON	+0.0	+999999	-1500

Steerpoint Data (OAP2) Entry

5. Select OAP2. For each entry in the following Table, place the thumbwheel and SPARE switch in the indicated positions, DATA OPT to BR0/BR1, enter the specified OAP2 bearing (LMD) and range (RMD), DATA OPT to E/N and enter the appropriate elevation (LMD).

YES NO

OAP2 DATA ENTRY				
TW #	SPARE SWITCH	BRNG LMD	RANGE RMD	ELEV LMD
0	OFF	+54.3	+5110	+31
1	OFF	+112.9	+71234	-5612
2	OFF	+32.7	+171	+512
3	OFF	+17.2	+2426	+1672
4	OFF	+289.4	+1567	+55
5	OFF	+351.5	+364	+1836
6	OFF	+109.7	+3476	-1007
7	OFF	+195.1	+1789	+571
8	OFF	+134.7	+7159	+1010
9	OFF	+18.7	+4741	+23780
0	ON	+156.3	+906	+11656
1	ON	+321.6	+8742	+6733
2	ON	+307.6	+57812	+75290
3	ON	+93.3	+122	-178
4	ON	+289.4	+12367	+37198
5	ON	+241.7	+8734	+2275
6	ON	+146.8	+31	+21356
7	ON	+77.8	+1732	+1299
8	ON	+359.9	+0	+80000
9	ON	+0.0	+999999	-1500

UTM Data Entry

6. Select DIR AIM, SPARE OFF. For each entry in the following Table, put the thumbwheel in the indicated position, DATA OPT to ORG, enter the UTM origin latitude (LMD) and longitude (RMD), DATA OPT to E/U and enter the UTM elevation (LMD) and grid East/North coordinates (RMD).

UTM DATA ENTRY PART 1				
TW #	ORG LAT LMD	ORG LONG RMD	ELEV LMD	GRID E/N RMD
D	N73°15.7′	W 87°55.1′	-1099	+878134
E	N 7°43.9′	E161°39.9′	+1859	+456999
F	S63°21.8′	E 0°33.3′	+80000	+000735

YES NO

UTM Data (OAP1) Entry

7. Select OAP1, SPARE OFF. For each entry in the following Table, put the thumbwheel in the indicated position, DATA OPT to BR0, enter the OAP1 bearing (LMD) and range (RMD), DATA OPT to E/N and enter the OAP1 elevation (LMD).

UTM DATA (OAP1) ENTRY			
TW #	BRNG LMD	RANGE RMD	ELEV LMD
D	+196.3	+15322	-6631
E	+11.5	+888	+17319
F	+0.0	+999999	-1500

UTM Data (OAP2) Entry

8. Select OAP2, SPARE OFF. For each entry in the following Table, put the thumbwheel in the indicated position, DATA OPT to BR0, enter the OAP2 bearing (LMD) and range (RMD), DATA OPT to E/N and enter the OAP2 elevation (LMD).

UTM DATA (OAP2) ENTRY			
TW #	BRNG LMD	RANGE RMD	ELEV LMD
D	+74.2	+37211	+21723
E	+247.7	+6119	-1409
F	+359.9	+0	+80000

Penguin Steerpoint Data Entry

9. Select DIR AIM, SPARE ON. For each entry in the following Table, put the thumbwheel in the indicated position, DATA OPT to L/L, enter the Penguin steerpoint latitude (LMD) and longitude (RMD), DATA OPT to E/T and enter the Penguin steerpoint elevation (LMD) and Time over Target (RMD), DATA OPT to V/T, enter the Penguin target velocity (LMD) and track (RMD), DATA OPT to TOD and enter the Penguin Time of Day (RMD).

YES NO

PENGUIN STEERPOINT DATA ENTRY 1							
TW #	LATITUDE LMD	LONGITUDE RMD	ELEVATION LMD	TOT RMD	VELOCITY LMD	TRACK RMD	TOD RMD
A	S88°52.2′	E163°35.1′	-1500	+214541	+1837	+314.5	+170845
B	N 7°47.2′	E 99°46.5′	+14667	+180703	+15	+78.0	+124503
C	N29°11.4′	W108°18.4′	+723	+032156	+758	+127.7	+080307
D	S37°17.9′	W144°38.4′	+2654	+193423	+0	+180.0	+235959
E	N19°58.3′	W 0°00.0′	+80000	+000000	+3	+0.0	+143721
F	S 0°00.0′	W180°00.0′	+152	+235959	+32564	+31.5	+000000

Penguin Waypoint Data Entry

10. Select OAP1, SPARE ON. For each entry in the following Table, put the thumbwheel in the indicated position, DATA OPT to WAY, enter the Penguin waypoint latitude (LMD) and longitude (RMD), DATA OPT to EWN and enter the waypoint elevation (LMD).

PENGUIN WAYPOINT DATA ENTRY			
TW #	LATITUDE LMD	LONGITUDE RMD	ELEVATION LMD
A	N73°12.9′	W 84°33.8′	+17356
B	N 8°53.1′	E137°43.0′	-272
C	S86°13.3′	E109°27.2′	+7891
D	S31°45.9′	W 67°57.1′	+183
E	S90°00.0′	W180°00.0′	-1500
F	N 0°00.0′	E 0°00.0′	+80000

Route Details Data Entry

11. Position DATA knob to CRUISE, DATA OPT to BGO, enter +1173 in the LMD (Fuel Bingo = 1173 lbs).

12. Position DATA knob to MISC, DATA OPT to LOC, enter +162 in the LMD (ILS localizer course = 162°).

13. Position FUNCTION knob to TCN FIX, enter +318.6 in the LMD (TACAN bearing = 318.6°) and +88.5 in the RMD (TACAN range = 88.5 nm).

YES NO

14. Position DATA knob to POS and FUNCTION knob to NAV, DATA OPT to E/A, and enter +2991 in the LMD (alignment elevation = 2,991 feet).

15. Position DATA knob to ALT CAL, DATA OPT to AGL, enter +291 in the LMD (Above Ground Level Altitude Limit = 291 feet), DATA OPT to MSL, and enter +1063 in the LMD (Mean Sea Level Altitude Limit = 1063 feet).

Target Geometry Data Entry

16. Position DATA knob to WPN DEL, DATA OPT to VIP B/R, enter +186.7 in the LMD (VIP to target bearing = 186.7°), enter +9086 in the RMD (VIP to target range = 9,086 feet), DATA OPT to ELV, enter +13471 in the LMD (VIP elevation = 13,471 feet), DATA OPT to X/Y, enter +491 in the LMD, and enter +376 in the RMD.

17. DATA OPT to VRP B/R, enter +297.4 in the LMD (target to VRP bearing = 297.4°), enter +8722 in the RMD (target to VRP range = 8,722 feet), DATA OPT to ELV, enter +7725 in the LMD (VRP elevation = 7,725 feet), DATA OPT to R/T, mode select, enter +6334 in the LMD (Manual Ballistics Range = 6,334 feet), enter 36.3 in the RMD (Manual Ballistics Time-of-Fall = 36.3 seconds), and de-mode select.

18. Position DATA knob to BCN, enter +249.3 in the LMD (BCN to target bearing = 249.3°), enter +1578 in the RMD (BCN to target range = 1,578 feet), DATA OPT to E/D, enter -868 in the LMD (BCN to target elevation = -868 feet), and enter +16.7 in the RMD (BCN time delay = 16.7 μsec).

19. Position the DATA knob to TISL, enter +16 in the RMD (IFF time between advisories = 16 minutes).

Mode Switching

20. Perform the following steps:
    a. Rotate the DATA knob to MISC.
    b. Rotate the DATA knob to TEST, DATA OPT to RDR, cycle MODE SEL.
    c. Rotate the DATA knob to ALT CAL, cycle MODE SEL.
    d. Position DATA knob to WPN DEL.
    e. Turn DATA knob back to POS, DATA OPT to E/A, and cycle MODE SEL.
    f. Put the DATA knob in the TISL position, cycle MODE SEL.
    g. Cycle FCC power.
    h. Turn the FUNCTION knob to FIX TCN.
    i. FUNCTION knob to SP.
    j. FUNCTION knob to FIX RDR.
    k. FUNCTION knob to NAV.

YES NO

l. Turn FCNP off.
m. Put FUNCTION knob back to NAV.
n. GEAR-UP OFF, depress LOAD on SCP twice, GEAR-UP ON.
o. MASTER ARM ON.
p. Select these weapon modes: AAM, Dogfight, LEV3, DTOS, VIP, LOFT, EOCCRP.

Steerpoint Data Verification

1. DATA knob to DEST, set to DIR AIM. For each entry in the following Table, set the thumbwheel and SPARE switch to the indicated positions, DATA OPT to steerpoint number, verify steerpoint latitude and longitude, DATA OPT to E/T and verify steerpoint elevation and Time-on-Target.

STEERPOINT DATA VERIFICATION						
TW #	SPARE SWITCH	LATITUDE LMD	LONGITUDE RMD	ELEV RMD	TOT RMD	CORRECT? YES NO
0	OFF	N17°41.7′	W118°04.3′	41	102337	✓ _
1	OFF	S45°54.8′	E102°22.5′	13	080706	✓ _
2	OFF	N13°23.7′	W 43°14.7′	323	010410	✓ _
3	OFF	S67°14.3′	W147°12.4′	452	023721	✓ _
4	OFF	N13°54.9′	E 93°21.8′	2374	112135	✓ _
5	OFF	S 8°12.3′	E100°11.7′	-782	112511	✓ _
6	OFF	S65°33.3′	W 91°31.8′	1005	032154	✓ _
7	OFF	N18°21.0′	W121°31.8′	331	074536	✓ _
8	OFF	N17°37.6′	W113°07.9′	1199	170054	✓ _
9	OFF	N32°21.0′	E171°16.9′	3912	045009	✓ _
0	ON	N39°23.9′	E 81°41.6′	-77	180211	✓ _
1	ON	S70°21.8′	W109°27.9′	12744	100939	✓ _
2	ON	N31°16.3′	E114°11.8′	6341	073000	✓ _
3	ON	N24°47.2′	W 21°57.0′	341	212103	✓ _
4	ON	N43°06.6′	E 4°26.5′	1024	101213	✓ _
5	ON	S15°24.7′	E127°13.7′	8149	000000	✓ _
6	ON	S31°44.4′	E 19°55.9′	-1500	183112	✓ _
7	ON	N 0°00.0′	E 0°00.0′	80000	235959	✓ _
8	ON	S90°00.0′	E180°00.0′	0	120001	_ _
9	ON	N89°59.9′	W 1°01.0′	1	235858	

YES NO

Steerpoint Data (OAP1) Verification

2. Select OAP1. For each entry in the following Table, put the thumbwheel and SPARE switch in the indicated positions, DATA OPT to BR0/BR1, verify OAP1 bearing and range, DATA OPT to E/N, and verify OAP1 elevation and number.

OAP1 DATA VERIFICATION						
TW #	SPARE SWITCH	BEARING LMD	RANGE RMD	ELEV LMD	OAP1 RMD	CORRECT? YES NO
0	OFF	112.6	8723	-333	0	✓ –
1	OFF	101.5	9913	1023	1	✓ –
2	OFF	32.7	171	512	2	✓ –
3	OFF	17.2	2426	1672	3	✓ –
4	OFF	289.4	1567	55	4	✓ –
5	OFF	351.5	364	1836	5	✓ –
6	OFF	109.7	3476	-1007	6	✓ –
7	OFF	195.1	1789	571	7	✓ –
8	OFF	134.7	7159	1010	8	✓ –
9	OFF	18.7	4741	23780	9	✓ –
0	ON	156.3	906	11656	10	✓ –
1	ON	321.6	8742	6733	11	✓ –
2	ON	307.6	57812	75290	12	✓ –
3	ON	93.3	122	-178	13	✓ –
4	ON	289.4	12367	37198	14	✓ –
5	ON	241.7	8734	2275	15	✓ –
6	ON	146.8	31	21356	16	✓ –
7	ON	77.8	1732	1299	17	✓ –
8	ON	359.9	0	80000	18	– –
9	ON	0.0	999999	-1500	19	

Steerpoint Data (OAP2) Verification

3. Select OAP2. For each entry in the following Table, put the thumbwheel and SPARE switch in the indicated positions, DATA OPT to BR0/BR1, verify OAP2 bearing and range, DATA OPT to E/N, and verify OAP2 elevation and number.

YES NO

OAP2 DATA VERIFICATION						
TW #	SPARE SWITCH	BEARING LMD	RANGE RMD	ELEV LMD	OAP1 RMD	CORRECT? YES NO
0	OFF	54.3	5110	31	0	✓ _
1	OFF	112.9	71234	-5612	1	✓ _
2	OFF	+32.7	+171	+512	2	✓ _
3	OFF	+17.2	+2426	+1672	3	✓ _
4	OFF	+289.4	+1567	+55	4	✓ _
5	OFF	+351.5	+364	+1836	5	✓ _
6	OFF	+109.7	+3476	-1007	6	✓ _
7	OFF	+195.1	+1789	+571	7	✓ _
8	OFF	+134.7	+7159	+1010	8	✓ _
9	OFF	+18.7	+4741	23780	9	✓ _
0	ON	+156.3	+906	11656	10	✓ _
1	ON	+321.6	+8742	+6733	11	✓ _
2	ON	+307.6	+57812	75290	12	✓ _
3	ON	+93.3	+122	-178	13	✓ _
4	ON	+289.4	+12367	37198	14	✓ _
5	ON	+241.7	+8734	+2275	15	✓ _
6	ON	+146.8	+31	21356	16	✓ _
7	ON	+77.8	+1732	+1299	17	✓ _
8	ON	+359.9	+0	80000	18	✓ _
9	ON	+0.0	999999	-1500	19	

UTM Data Verification

4. Select DIR AIM, SPARE OFF. For each entry in the following Table, put thumbwheel in the indicated position, DATA OPT to ORG, verify UTM origin latitude (RMD) and longitude (LMD), DATA OPT to E/U, and verify UTM elevation (LMD) and grid coordinates (RMD).

UTM DATA VERIFICATION PART 1					
TW #	ORG LAT LMD	ORG LONG RMD	ELEV LMD	GRID COORD RMD	CORRECT? YES NO
D	N73°15.7′	W 87°55.1′	-1099	878134	✓ _
E	N 7°43.9′	E161°39.9′	1859	456999	✓ _
F	S63°21.8′	E 0°33.3′	80000	000735	✓ _

YES NO

5. DATA OPT to L/L. Verify each entry in the following Table.

UTM DATA VERIFICATION PART 2			
TW #	GRID LAT LMD	GRID LONG RMD	CORRECT? YES NO
D	N73°23.6′	W 85°10.4′	✓ –
E	N 8°38.3′	E162°04.3′	✓ –
F	S62°42.3′	E 0°36.6′	✓ –

UTM Data (OAP1) Verification

6. Select OAP1, SPARE switch OFF. For each entry in the following Table, put the thumbwheel in the indicated position, DATA OPT to BR0, verify OAP1 bearing and range, DATA OPT to E/N, and verify OAP1 elevation and number.

UTM OAP1 DATA VERIFICATION					
TW #	BEARING LMD	RANGE RMD	ELEV LMD	OAP1 RMD	CORRECT? YES NO
D	196.3	15322	-6631	23	✓ –
E	11.5	888	17319	24	✓ –
F	0.0	999999	-1500	25	✓ –

UTM Data (OAP2) Verification

7. Select OAP2, SPARE switch OFF. For each entry in the following Table, put the thumbwheel in the indicated position, DATA OPT to BR0, verify OAP2 bearing and range, DATA OPT to E/N, and verify OAP2 elevation and number.

UTM OAP2 DATA VERIFICATION					
TW #	BEARING LMD	RANGE RMD	ELEV LMD	OAP2 RMD	CORRECT? YES NO
D	74.2	37211	21723	23	✓ –
E	247.7	6119	-1409	24	✓ –
F	359.9	0	80000	25	✓ –

YES NO

Penguin Steerpoint Data Verification

8. Select DIR AIM, SPARE switch ON. For each entry in the following Table, put the thumbwheel in the indicated position, DATA OPT to L/L, verify Penguin steerpoint latitude (LMD) and longitude (RMD), DATA OPT to E/T, and verify Penguin steerpoint elevation (LMD) and Time over Target (RMD), DATA OPT to V/T, verify Penguin target velocity (LMD) and track (RMD), DATA OPT to TOD, and verify Penguin time of day (RMD).

PENGUIN STEERPOINT DATA ENTRY 1								
TW #	LATITUDE LMD	LONGITUDE RMD	ELEVATION LMD	TOT RMD	VELOCITY LMD	TRACK RMD	TOD RMD	CORRECT? YES NO
A	S88°52.2′	E163°35.1′	-1500	+214541	+1837	+314.5	+170845	✓ –
B	N 7°47.2′	E 99°46.5′	+14667	+180703	+15	+78.0	+124503	✓ –
C	N29°11.4′	W108°18.4′	+723	+032156	+758	+127.7	+080307	✓ –
D	S37°17.9′	W144°38.4′	+2654	+193423	+0	+180.0	+235959	✓ –
E	N19°58.3′	E 0°00.0′	+80000	+000000	+3	+0.0	+143721	✓ –
F	N 0°00.0′	W180°00.0′	+152	+235959	+32564	+31.5	+000000	– –

Penguin Waypoint Data Verification

9. Select OAP2, SPARE switch ON. For each entry in the following Table, put the thumbwheel in the indicated position, DATA OPT to WAY, verify waypoint latitude (LMD) and longitude (RMD), DATA OPT to EWN, and verify waypoint elevation (LMD) and number (RMD).

PENGUIN WAYPOINT DATA VERIFICATION					
TW #	LATITUDE LMD	LONGITUDE RMD	ELEVATION LMD	WAY RMD	CORRECT? YES NO
A	N73°12.9′	W 84°33.8′	17356	26	✓ –
B	N 8°53.1′	E137°43.0′	-272	27	✓ –
C	S86°13.3′	E109°27.2′	7891	28	✓ –
D	S31°45.9′	W 67°57.1′	183	29	✓ –
E	S90°00.0′	W180°00.0′	-1500	30	✓ –
F	N 0°00.0′	E 0°00.0′	80000	31	– –

Route Details Data Verification

10. Position DATA knob to CRUISE, DATA OPT to BGO. Verify:
1173 is displayed in RMD ✓ ___

		YES	NO
11.	Position DATA knob to MISC, DATA OPT to LOC. Verify:		
	162 is displayed in LMD	✓	
12.	Position the FUNCTION knob to TCN FIX. Verify:		
	318.6 is displayed in LMD	✓	
	88.5 is displayed in RMD	✓	
13.	Position DATA knob to POS, FUNCTION knob to NAV, DATA OPT to E/A. Verify:		
	2991 is displayed in LMD	✓	
14.	Position DATA knob to ALT CAL, DATA OPT to AGL. Verify:		
	291 is displayed in LMD	✓	
15.	DATA OPT to MSL. Verify:		
	1063 is displayed in LMD	✓	

Target Geometry Data Verification

16.	Position DATA knob to WPN DEL, DATA OPT to VIP B/R. Verify:		
	186.7 is displayed in LMD	✓	
	9086 is displayed in RMD	✓	
17.	DATA OPT to ELV. Verify:		
	13471 is displayed in LMD	✓	
18.	DATA OPT to X/Y. Verify:		
	491 is displayed in LMD	✓	
	376 is displayed in RMD	✓	
19.	DATA OPT to VRP B/R. Verify:		
	297.4 is displayed in LMD	✓	
	8722 is displayed in RMD	✓	
20.	DATA OPT to ELV. Verify:		
	7725 is displayed in LMD	✓	
21.	DATA OPT to R/T and MODE SEL. Verify:		
	6334 is displayed in LMD	✓	
	36.3 is displayed in RMD	✓	

		YES	NO
22.	De-MODE SEL. Position DATA knob to BCN. Verify:		
	249.3 is displayed in LMD	✓	
	1578 is displayed in RMD	✓	
23.	DATA OPT to E/D. Verify:		
	-868 is displayed in LMD	✓	
	16.7 is displayed in RMD	✓	
24.	Position DATA knob to TISL. Verify:		
	16 is displayed in RMD	✓	

25. Enter DISPLAY program, select #3, #1, enter WLAT as the variable name, then type EXIT and #4. Put the DATA knob in the POS position. For each entry in the following Table, verify that the FCC DATA latitude and longitude displayed on the C&M CRT matches the indicated values rounded to the nearest .1'.

Note: The following section was not tested. The test procedure is in the process of being revised. The ability to view INU waypoint data is no longer needed. XFCC MUX traffic will be monitored to determine the necessary information.

INU STEERPOINT DATA VERIFICATION				
TW #	SPARE SWITCH	LATITUDE	LONGITUDE	CORRECT? YES NO
0	OFF	N17°41.7′	W118°04.3′	_ _
1	OFF	S45°54.8′	E102°22.5′	_ _
2	OFF	N13°23.7′	W 43°14.7′	_ _
3	OFF	S67°14.3′	W147°12.4′	_ _
4	OFF	N13°54.9′	E 93°21.8′	_ _
5	OFF	S 8°12.3′	E100°11.7′	_ _
6	OFF	S65°33.3′	W 91°31.8′	_ _
7	OFF	N18°21.0′	W121°31.8′	_ _
8	OFF	N17°37.6′	W113°07.9′	_ _
9	OFF	N32°21.0′	E171°16.9′	_ _
0	ON	N39°23.9′	E 81°41.6′	_ _
1	ON	S70°21.8′	W109°27.9′	_ _
2	ON	N31°16.3′	E114°11.8′	_ _
3	ON	N24°47.2′	W 21°57.0′	_ _
4	ON	N43°06.6′	E 4°26.5′	_ _
5	ON	S15°24.7′	E127°13.7′	_ _
6	ON	S31°44.4′	E 19°55.9′	_ _
7	ON	N 0°00.0′	E 0°00.0′	_ _
8	ON	S90°00.0′	E180°00.0′	_ _
9	ON			

YES NO

INU STEERPOINT DATA VERIFICATION				
TW #	SPARE SWITCH	LATITUDE	LONGITUDE	CORRECT? YES NO
		N89°59.9′	W 1°00.0′	

26. Select PWR ON mode on SCP, GEAR DOWN. Rotate DATA knob to DEST, DIR AIM ON, SPARE OFF, thumbwheel 4. Enter S47°39.6′ in the LMD and W173°13.7′ in the RMD. Rotate DATA knob to WPN DEL. Cycle FCC power. Rotate DATA knob to DEST. Verify:

S47°39.6′ is displayed in the LMD ✓ ___
W173°13.7′ is displayed in the RMD ✓ ___

27. GEAR UP. Depress the FCNP MARK pushbutton repeatedly and verify:

Alpha display shows MKA, MKB, MKC ✓ ___

28. Select the MKC rotary option, FREEZE OFF. Fly the aircraft for a few seconds, then freeze. Rotate the DATA knob to POS and record the present aircraft latitude and longitude as displayed in the LMD and RMD: Latitude (LMD) _N 0.5___ Longitude (RMD) _E 0.0____. Press the MARK pushbutton. Verify:

MKA is displayed in the FCNP Alpha display ✓ ___

29. FREEZE OFF. Fly the aircraft for a few seconds, then freeze. Rotate the DATA knob to POS and record the present aircraft latitude and longitude as displayed in the LMD and RMD: Latitude (LMD) _N 3.4___ Longitude (RMD) _W 0.2__. Press the MARK pushbutton. Verify:

MKB is displayed in the FCNP Alpha display ✓ ___

30. FREEZE OFF. Fly the aircraft for a few seconds, then freeze. Rotate the DATA knob to POS and record the present aircraft latitude and longitude as displayed in the LMD and RMD: Latitude (LMD) _N 4.4___ Longitude (RMD) _E 0.2__. Press the MARK pushbutton. Verify:

MKC is displayed in the FCNP Alpha display ✓ ___

31. Reset simulation. Rotate DATA knob to DEST and select thumbwheel A. Verify:

Lat/long matches previous step ±0.1 min ✓ ___

32. Select thumbwheel B. Verify:

Lat/long matches previous step ±0.1 min ✓ ___

33. Select thumbwheel C. Verify:

Lat/long matches previous step ±0.1 min ✓ ___

YES NO

END OF TEST

DTE MISSION ENTRY AND RETRIEVAL NOT PERFORMED
- NO DTE ON AMPSE

THIS PAGE INTENTIONALLY LEFT BLANK

Appendix B

20.0 MANUALLY GENERATED AUTOVAL SCRIPT FOR THE FIRE CONTROL NAVIGATION PANEL MISSION ENTRY AND RETRIEVAL PORTION OF THE F-16A/B BLOCK 15Z1B FORMAL QUALIFICATION TEST

THIS PAGE INTENTIONALLY LEFT BLANK

```
! File Name:  OFP_FCC_MISSON_PLANNING.AVC
!
! Assumptions: none
!
! Description:
!     This file will perform several phases of Mission Planning
!     Testing:
!       - initialization and setup
!       - Entering Massive amounts of data through the
!         Fire Control/Navigation Panel (FCNP)


        ; Step 1 Load INI File Miss.ini
        $ @MAC$ROOT:MAC_AVL_LOAD_COND MISS

        ;Initialize position of all the switches
        @Avl_Ini_Switch_Init

        @Avl_Ini_Clear_Autopilot  ;Clear Autopilot

        ;set autopilot to prevent "PULL-UP" warnings
        Airspeed 500
        Climb 1

        ;Perform common initialization and AMPSE configuration
        @OFP_FCC_COMMON_CONFIG


        print " "
        print "=====>> MISSION PLANNING DATA ENTRY <<====="


        turn Imsp_Mode_switch Nav

        set  Panel HUD
        turn FPM_Switch AttFPM
        set  Scales_Switch EMHVV
        set  ICMode On

        set Panel FCNP


        ;Step 3 of the procedures
        print ""
        print "**** Begin Steerpoint Data Entry"

        turn Data_knob Dest
        set  Aimpoint DirAim

        set Keyboard On

        ;Enter the Latitude, Long, Steerpt Elevation and
        ;Time on Target values.
        print "    SteerPoint 0"
        set Thumbwheel 0
        print "        Lat = N17 41.7   Long = W118 04.3"
        set Keyin N
        set Keyin 1
        set Keyin 7
        set Keyin 4
        set Keyin 1
        set Keyin 7
        set Enter On

        set Keyin W
        set Keyin 1
        set Keyin 1
        set Keyin 8
        set Keyin 0
        set Keyin 4
        set Keyin 3
        set Enter On

        set Data_Opt On
        print "        Elv = +   41     ToT  = +102337"
        set Keyin N
        set Keyin 4
        set Keyin 1
        set Enter On

        set Keyin E
        set Keyin 1
        set Keyin 0
        set Keyin 2
        set Keyin 3
        set Keyin 3
        set Keyin 7
        set Enter On
        set Data_Opt On

        print "    SteerPoint 1"
        set Thumbwheel 1
        print "        Lat = S45 54.8   Long = E102 22.5"
        set Keyin S
        set Keyin 4
        set Keyin 5
        set Keyin 5
        set Keyin 4
        set Keyin 8
        set Enter On

        set Keyin E
        set Keyin 1
        set Keyin 0
        set Keyin 2
        set Keyin 2
        set Keyin 2
        set Keyin 5
        set Enter On
        set Data_Opt On
        print "        Elv = +   13     ToT = +080706"
        set Keyin N
        set Keyin 1
        set Keyin 3
        set Enter On

        set Keyin E
        set Keyin 8
        set Keyin 0
        set Keyin 7
        set Keyin 0
        set Keyin 6
        set Enter On
        set Data_Opt On

        print "    SteerPoint 2"
        set Thumbwheel 2
        print "        Lat = N13 23.7   Long = W 43 14.7"
        set Keyin N
        set Keyin 1
        set Keyin 3
        set Keyin 2
        set Keyin 3
        set Keyin 7
        set Enter On

        set Keyin W
        set Keyin 4
        set Keyin 3
        set Keyin 1
        set Keyin 4
        set Keyin 7
        set Enter On

        set Data_Opt On
        print "        Elv = +  323     ToT  = +010410"
        set Keyin N
        set Keyin 3
        set Keyin 2
        set Keyin 3
        set Enter On

        set Keyin E
        set Keyin 1
        set Keyin 0
        set Keyin 4
        set Keyin 1
        set Keyin 0
        set Enter On
        set Data_Opt On

        print "    SteerPoint 3"
        set Thumbwheel 3
        print "        Lat = S67 14.3   Long = W147 12.4"
        set Keyin S
        set Keyin 6
        set Keyin 7
        set Keyin 1
        set Keyin 4
        set Keyin 3
        set Enter On

        set Keyin W
        set Keyin 1
        set Keyin 4
        set Keyin 7
        set Keyin 1
        set Keyin 2
        set Keyin 4
        set Enter On

        set Data_Opt On
        print "        Elv = +  452     ToT  = +023721"
        set Keyin N
```

```
set Keyin 4
set Keyin 5
set Keyin 2
set Enter On

set Keyin E
set Keyin 2
set Keyin 3
set Keyin 7
set Keyin 2
set Keyin 1
set Enter On
set Data_Opt On

print "    SteerPoint 4"
set Thumbwheel 4
print "        Lat = N13 54.9   Long = E 93 21.8"
set Keyin N
set Keyin 1
set Keyin 3
set Keyin 5
set Keyin 4
set Keyin 9
set Enter On

set Keyin E
set Keyin 9
set Keyin 3
set Keyin 2
set Keyin 1
set Keyin 8
set Enter On

set Data_Opt On
print "        Elv = +  2374     ToT  = +112135"
set Keyin N
set Keyin 2
set Keyin 3
set Keyin 7
set Keyin 4
set Enter on

set Keyin E
set Keyin 1
set Keyin 1
set Keyin 2
set Keyin 1
set Keyin 3
set Keyin 5
set Enter On
set Data_Opt On

print "    SteerPoint 5"
set Thumbwheel 5
print "        Lat = S 8 12.3   Long = E100 11.7"
set Keyin S
set Keyin 8
set Keyin 1
set Keyin 2
set Keyin 3
set Enter On

set Keyin E
set Keyin 1
set Keyin 0
set Keyin 0
set Keyin 1
set Keyin 1
set Keyin 7
set Enter On

set Data_Opt On
print "        Elv = -  782      ToT  = +112511"
set Keyin S
set Keyin 7
set Keyin 8
set Keyin 2
set Enter On

set Keyin E
set Keyin 1
set Keyin 1
set Keyin 2
set Keyin 5
set Keyin 1
set Keyin 1
set Enter On
set Data_Opt On

print "    SteerPoint 6"
set Thumbwheel 6
print "        Lat = S65 33.3   Long = W 91 31.8"
set Keyin S
set Keyin 6
set Keyin 5
set Keyin 3
set Keyin 3
set Keyin 3
set Enter On

set Keyin W
set Keyin 9
set Keyin 1
set Keyin 3
set Keyin 1
set Keyin 8
set Enter On

set Data_Opt On
print "        Elv = + 1005      ToT  = +032154"
set Keyin N
set Keyin 1
set Keyin 0
set Keyin 0
set Keyin 5
set Enter On

set Keyin E
set Keyin 3
set Keyin 2
set Keyin 1
set Keyin 5
set Keyin 4
set Enter On
set Data_Opt On

print "    SteerPoint 7"
set Thumbwheel 7
print "        Lat = N18 21.0   Long = W121 31.8"
set Keyin N
set Keyin 1
set Keyin 8
set Keyin 2
set Keyin 1
set Keyin 0
set Enter On

set Keyin W
set Keyin 1
set Keyin 2
set Keyin 1
set Keyin 3
set Keyin 1
set Keyin 8
set Enter On

set Data_Opt On
print "        Elv = + 0331      ToT  = +074536"
set Keyin N
set Keyin 3
set Keyin 3
set Keyin 1
set Enter On

set Keyin E
set Keyin 7
set Keyin 4
set Keyin 5
set Keyin 3
set Keyin 6
set Enter On
set Data_Opt On

print "    SteerPoint 8"
set Thumbwheel 8
print "        Lat = N17 37.6   Long = W113 07.9"
set Keyin N
set Keyin 1
set Keyin 7
set Keyin 3
set Keyin 7
set Keyin 6
set Enter On

set Keyin W
set Keyin 1
set Keyin 1
set Keyin 3
set Keyin 0
set Keyin 7
set Keyin 9
set Enter On

set Data_Opt On
```

```
print "        Elv = + 1199      ToT  = +170054"
set Keyin N
set Keyin 1
set Keyin 1
set Keyin 9
set Keyin 9
set Enter On

set Keyin E
set Keyin 1
set Keyin 7
set Keyin 0
set Keyin 0
set Keyin 5
set Keyin 4
set Enter On
set Data_Opt On

print "    SteerPoint 9"
set Thumbwheel 9
print "        Lat = N33 21.0   Long = E171 16.9"
set Keyin N
set Keyin 3
set Keyin 3
set Keyin 2
set Keyin 1
set Keyin 0
set Enter On

set Keyin E
set Keyin 1
set Keyin 7
set Keyin 1
set Keyin 1
set Keyin 6
set Keyin 9
set Enter On
set Data_Opt On
print "        Elv = + 3912      ToT  = +045009"
set Keyin N
set Keyin 3
set Keyin 9
set Keyin 1
set Keyin 2
set Enter On

set Keyin E
set Keyin 4
set Keyin 5
set Keyin 0
set Keyin 0
set Keyin 9
set Enter On
set Data_Opt On

set Spare_Button On
print "    SteerPoint 19"
set Thumbwheel 9
print "        Lat = N89 59.9   Long = W  1 01.0"
set Keyin N
set Keyin 8
set Keyin 9
set Keyin 5
set Keyin 9
set Keyin 9
set Enter On

set Keyin W
set Keyin 1
set Keyin 0
set Keyin 1
set Keyin 0
set Enter On

print "        Elv = +    1      ToT  = +235868"
set Data_Opt On
set Keyin N
set Keyin 1
set Enter On

set Keyin E
set Keyin 2
set Keyin 3
set Keyin 5
set Keyin 8
set Keyin 5
set Keyin 8
set Enter On
set Data_Opt On

print "    SteerPoint 18"
set Thumbwheel 8
print "        Lat = S90 00.0   Long = E180 00.0"
set Keyin S
set Keyin 9
set Keyin 0
set Keyin 0
set Keyin 0
set Keyin 0
set Enter On

set Keyin E
set Keyin 1
set Keyin 8
set Keyin 0
set Keyin 0
set Keyin 0
set Keyin 0
set Enter On

set Data_Opt On
print "        Elv = +    0      ToT  = +120001"
set Keyin N
set Keyin 0
set Enter On

set Keyin E
set Keyin 1
set Keyin 2
set Keyin 0
set Keyin 0
set Keyin 0
set Keyin 1
set Enter On
set Data_Opt On

print "    SteerPoint 17"
set Thumbwheel 7
print "        Lat = N 0 00.0   Long = W 0  00.0"
set Keyin N
set Keyin 0
set Keyin 0
set Keyin 0
set Keyin 0
set Enter On
set Keyin W
set Keyin 0
set Keyin 0
set Keyin 0
set Keyin 0
set Enter On

set Data_Opt On
print "        Elv = +80000      ToT  = +235959"
set Keyin N
set Keyin 8
set Keyin 0
set Keyin 0
set Keyin 0
set Keyin 0
set Enter On

set Keyin E
set Keyin 2
set Keyin 3
set Keyin 5
set Keyin 9
set Keyin 5
set Keyin 9
set Enter On
set Data_Opt On

print "    SteerPoint 16"
set Thumbwheel 6
print "        Lat = S31 44.4   Long = E 19 55.9"
set Keyin S
set Keyin 3
set Keyin 1
set Keyin 4
set Keyin 4
set Keyin 4
set Enter On

set Keyin E
set Keyin 1
set Keyin 9
set Keyin 5
set Keyin 5
set Keyin 9
set Enter On

set Data_Opt On
print "        Elv = - 1500      ToT  = +183112"
set Keyin S
```

```
set Keyin 1
set Keyin 5
set Keyin 0
set Keyin 0
set Enter On

set Keyin E
set Keyin 1
set Keyin 8
set Keyin 3
set Keyin 1
set Keyin 1
set Keyin 2
set Enter On
set Data_Opt On

print "    SteerPoint 15"
set Thumbwheel 5
print "        Lat = S15 24.7   Long = E127 13.7"
set Keyin S
set Keyin 1
set Keyin 5
set Keyin 2
set Keyin 4
set Keyin 7
set Enter On

set Keyin E
set Keyin 1
set Keyin 2
set Keyin 7
set Keyin 1
set Keyin 3
set Keyin 7
set Enter On

set Data_Opt On
print "        Elv = + 8149     ToT  = +000000"
set Keyin N
set Keyin 8
set Keyin 1
set Keyin 4
set Keyin 9
set Enter On

set Keyin E
set Keyin 0
set Enter On
set Data_Opt On

print "    SteerPoint 14"
set Thumbwheel 4
print "        Lat = N43 06.6   Long = E  4 26.5"
set Keyin N
set Keyin 4
set Keyin 3
set Keyin 0
set Keyin 6
set Keyin 6
set Enter On

set Keyin E
set Keyin 4
set Keyin 2
set Keyin 6
set Keyin 5
set Enter On

set Data_Opt On
print "        Elv = + 1024     ToT  = +101213"
set Keyin N
set Keyin 1
set Keyin 0
set Keyin 2
set Keyin 4
set Enter On

set Keyin E
set Keyin 1
set Keyin 0
set Keyin 1
set Keyin 2
set Keyin 1
set Keyin 3
set Enter On
set Data_Opt On

print "    SteerPoint 13"
set Thumbwheel 3
print "        Lat = N24 47.2   Long = W 21 57.0"
set Keyin N
set Keyin 2
set Keyin 4
set Keyin 4
set Keyin 7
set Keyin 2
set Enter On

set Keyin W
set Keyin 2
set Keyin 1
set Keyin 5
set Keyin 7
set Keyin 0
set Enter On

set Data_Opt On
print "        Elv =  +  341    ToT  = +212103"
set Keyin N
set Keyin 3
set Keyin 4
set Keyin 1
set Enter On

set Keyin E
set Keyin 2
set Keyin 1
set Keyin 2
set Keyin 1
set Keyin 0
set Keyin 3
set Enter On
set Data_Opt On

print "    SteerPoint 12"
set Thumbwheel 2
print "        Lat = N31 16.3   Long = E114 11.8"
set Keyin N
set Keyin 3
set Keyin 1
set Keyin 1
set Keyin 6
set Keyin 3
set Enter On

set Keyin E
set Keyin 1
set Keyin 1
set Keyin 4
set Keyin 1
set Keyin 1
set Keyin 8
set Enter On

set Data_Opt On
print "        Elv = + 6341     ToT  = +073000"
set Keyin N
set Keyin 6
set Keyin 3
set Keyin 4
set Keyin 1
set Enter On

set Keyin E
set Keyin 7
set Keyin 3
set Keyin 0
set Keyin 0
set Keyin 0
set Enter On
set Data_Opt On

print "    SteerPoint 11"
set Thumbwheel 1
print "        Lat = S70 21.8   Long = W109 27.9"
set Keyin S
set Keyin 7
set Keyin 0
set Keyin 2
set Keyin 1
set Keyin 8
set Enter On

set Keyin W
set Keyin 1
set Keyin 0
set Keyin 9
set Keyin 2
set Keyin 7
set Keyin 9
set Enter On

set Data_Opt On
print "        Elv = +12744     ToT  = +100939"
```

```
set Keyin N
set Keyin 1
set Keyin 2
set Keyin 7
set Keyin 4
set Keyin 4
set Enter On

set Keyin E
set Keyin 1
set Keyin 0
set Keyin 0
set Keyin 9
set Keyin 3
set Keyin 9
set Enter On
set Data_Opt On

print "    SteerPoint 10"
set Thumbwheel 0
print "        Lat = N39 23.9   Long = E 81 41.6"
set Keyin N
set Keyin 3
set Keyin 9
set Keyin 2
set Keyin 3
set Keyin 9
set Enter On

set Keyin E
set Keyin 8
set Keyin 1
set Keyin 4
set Keyin 1
set Keyin 6
set Enter On

set Data_Opt On
print "        Elv = -   77     ToT  = +180211"
set Keyin S
set Keyin 7
set Keyin 7
set Enter On

set Keyin E
set Keyin 1
set Keyin 8
set Keyin 0
set Keyin 2
set Keyin 1
set Keyin 1
set Enter On
set Data_Opt On
set Spare_Button Off
print "**** Steerpoint Data Entry Complete"
print ""



; Step 4 of the procedures
print "**** Begin Offset Aimpoint 1 (OAP1) Data Entry"
turn Data_Knob Dest
set  Aimpoint OAP1

print "    SteerPoint 0"
set Thumbwheel 0
print "        Bearing   = +112.6   Range = +  8723"
set Keyin N
set Keyin 1
set Keyin 1
set Keyin 2
set Keyin 6
set Enter On
set Keyin E
set Keyin 8
set Keyin 7
set Keyin 2
set Keyin 3
set Enter On

print "        Elevation = -  333"
set Data_Opt On
set Keyin S
set Keyin 3
set Keyin 3
set Keyin 3
set Enter On

print "    SteerPoint 1"
set Data_Opt On
set Thumbwheel 1
print "        Bearing   = +101.5   Range = +  9913"
set Keyin N
set Keyin 1
set Keyin 0
set Keyin 1
set Keyin 5
set Enter On
set Keyin E
set Keyin 9
set Keyin 9
set Keyin 1
set Keyin 3
set Enter On

print "        Elevation = + 1023"
set Data_Opt On
set Keyin N
set Keyin 1
set Keyin 0
set Keyin 2
set Keyin 3
set Enter on

print "    SteerPoint 2"
set Data_Opt On
set Thumbwheel 2
print "        Bearing   = + 32.7   Range = +   171"
set Keyin N
set Keyin 3
set Keyin 2
set Keyin 7
set Enter On
set Keyin E
set Keyin 1
set Keyin 7
set Keyin 1
set Enter On

print "        Elevation = +  512"
set Data_Opt On
set Keyin N
set Keyin 5
set Keyin 1
set Keyin 2
set Enter On

print "    SteerPoint 3"
set Data_Opt On
set Thumbwheel 3
print "        Bearing   = + 17.2   Range = +  2426"
set Keyin N
set Keyin 1
set Keyin 7
set Keyin 2
set Enter On
set Keyin E
set Keyin 2
set Keyin 4
set Keyin 2
set Keyin 6
set Enter On

print "        Elevation = + 1672"
set Data_Opt On
set Keyin N
set Keyin 1
set Keyin 6
set Keyin 7
set Keyin 2
set Enter On

print "    SteerPoint 4"
set Data_Opt On
set Thumbwheel 4
print "        Bearing   = +289.4   Range = +  1567"
set Keyin N
set Keyin 2
set Keyin 8
set Keyin 9
set Keyin 4
set Enter On
set Keyin E
set Keyin 1
set Keyin 5
set Keyin 6
set Keyin 7
set Enter On

print "        Elevation = +   55"
set Data_Opt On
set Keyin N
set Keyin 5
set Keyin 5
```

```
set Enter on

print "    SteerPoint 5"
set Data_Opt On
set Thumbwheel 5
print "        Bearing   = +351.5   Range = +   364"
set Keyin N
set Keyin 3
set Keyin 5
set Keyin 1
set Keyin 5
set Enter On
set Keyin E
set Keyin 3
set Keyin 6
set Keyin 4
set Enter On

print "        Elevation = + 1836"
set Data_Opt On
set Keyin N
set Keyin 1
set Keyin 8
set Keyin 3
set Keyin 6
set Enter On

print "    SteerPoint 6"
set Data_Opt On
set Thumbwheel 6
print "        Bearing   = +109.7   Range = +  3476"
set Keyin N
set Keyin 1
set Keyin 0
set Keyin 9
set Keyin 7
set Enter On
set Keyin E
set Keyin 3
set Keyin 4
set Keyin 7
set Keyin 6
set Enter On

print "        Elevation = - 1007"
set Data_Opt On
set Keyin S
set Keyin 1
set Keyin 0
set Keyin 0
set Keyin 7
set Enter On

print "    SteerPoint 7"
set Data_Opt On
set Thumbwheel 7
print "        Bearing   = +195.1   Range = +  1789"
set Keyin N
set Keyin 1
set Keyin 9
set Keyin 5
set Keyin 1
set Enter On
set Keyin E
set Keyin 1
set Keyin 7
set Keyin 8
set Keyin 9
set Enter On

print "        Elevation = +  571"
set Data_Opt On
set Keyin N
set Keyin 5
set Keyin 7
set Keyin 1
set Enter On

print "    SteerPoint 8"
set Data_Opt On
set Thumbwheel 8
print "        Bearing   = +134.7   Range = +  7159"
set Keyin N
set Keyin 1
set Keyin 3
set Keyin 4
set Keyin 7
set Enter On
set Keyin E
set Keyin 7
set Keyin 1
set Keyin 5
set Keyin 9
set Enter On

print "        Elevation = + 1010"
set Data_Opt On
set Keyin N
set Keyin 1
set Keyin 0
set Keyin 1
set Keyin 0
set Enter On

print "    SteerPoint 9"
set Data_Opt On
set Thumbwheel 9
print "        Bearing   = + 18.7   Range = +  4741"
set Keyin N
set Keyin 1
set Keyin 8
set Keyin 7
set Enter On
set Keyin E
set Keyin 4
set Keyin 7
set Keyin 4
set Keyin 1
set Enter On

print "        Elevation = +23780"
set Data_Opt On
set Keyin N
set Keyin 2
set Keyin 3
set Keyin 7
set Keyin 8
set Keyin 0
set Enter On

print "    SteerPoint 19"
set Spare_Button On
set Data_Opt On
print "        Bearing   = +  0.0   Range = +999999"
set Keyin N
set Keyin 0
set Enter On
set Keyin E
set Keyin 9
set Keyin 9
set Keyin 9
set Keyin 9
set Keyin 9
set Keyin 9
set Enter On

print "        Elevation = - 1500"
set Data_Opt On
set Keyin S
set Keyin 1
set Keyin 5
set Keyin 0
set Keyin 0
set Enter On

print "    SteerPoint 18"
set Data_Opt On
set Thumbwheel 8
print "        Bearing   = +359.9   Range = +     0"
set Keyin N
set Keyin 3
set Keyin 5
set Keyin 9
set Keyin 9
set Enter On
set Keyin E
set Keyin 0
set Enter On

print "        Elevation = +80000"
set Data_Opt On
set Keyin N
set Keyin 8
set Keyin 0
set Keyin 0
set Keyin 0
set Keyin 0
set Enter On

print "    SteerPoint 17"
set Data_Opt On
set Thumbwheel 7
print "        Bearing   = + 77.8   Range = +  1732"
set Keyin N
```

```
set Keyin 7
set Keyin 7
set Keyin 8
set Enter On
set Keyin E
set Keyin 1
set Keyin 7
set Keyin 3
set Keyin 2
set Enter On

print "        Elevation = + 1299"
set Data_Opt On
set Keyin N
set Keyin 1
set Keyin 2
set Keyin 9
set Keyin 9
set Enter On

print "    SteerPoint 16"
set Data_Opt On
set Thumbwheel 6
print "        Bearing   = +146.8   Range = +    31"
set Keyin N
set Keyin 1
set Keyin 4
set Keyin 6
set Keyin 8
set Enter On
set Keyin E
set Keyin 3
set Keyin 1
set Enter On

print "        Elevation = +21356"
set Data_Opt On
set Keyin N
set Keyin 2
set Keyin 1
set Keyin 3
set Keyin 5
set Keyin 6
set Enter On

print "    SteerPoint 15"
set Data_Opt On
set Thumbwheel 5
print "        Bearing   = +241.7   Range = +  8734"
set Keyin N
set Keyin 2
set Keyin 4
set Keyin 1
set Keyin 7
set Enter On
set Keyin E
set Keyin 8
set Keyin 7
set Keyin 3
set Keyin 4
set Enter On

print "        Elevation = + 2275"
set Data_Opt On
set Keyin N
set Keyin 2
set Keyin 2
set Keyin 7
set Keyin 5
set Enter On

print "    SteerPoint 14"
set Data_Opt On
set Thumbwheel 4
print "        Bearing   = +289.4   Range = + 12367"
set Keyin N
set Keyin 2
set Keyin 8
set Keyin 9
set Keyin 4
set Enter On
set Keyin E
set Keyin 1
set Keyin 2
set Keyin 3
set Keyin 6
set Keyin 7
set Enter On

print "        Elevation = +37198"
set Data_Opt On
set Keyin N
set Keyin 3
set Keyin 7
set Keyin 1
set Keyin 9
set Keyin 8
set Enter On

print "    SteerPoint 13"
set Data_Opt On
set Thumbwheel 3
print "        Bearing   = + 93.3   Range = +   122"
set Keyin N
set Keyin 9
set Keyin 3
set Keyin 3
set Enter On
set Keyin E
set Keyin 1
set Keyin 2
set Keyin 2
set Enter On

print "        Elevation = -  178"
set Data_Opt On
set Keyin S
set Keyin 1
set Keyin 7
set Keyin 8
set Enter On

print "    SteerPoint 12"
set Data_Opt On
set Thumbwheel 2
print "        Bearing   = +307.6   Range = + 57812"
set Keyin N
set Keyin 3
set Keyin 0
set Keyin 7
set Keyin 6
set Enter On
set Keyin E
set Keyin 5
set Keyin 7
set Keyin 8
set Keyin 1
set Keyin 2
set Enter On

print "        Elevation = +75290"
set Data_Opt On
set Keyin N
set Keyin 7
set Keyin 5
set Keyin 2
set Keyin 9
set Keyin 0
set Enter On

print "    SteerPoint 11"
set Data_Opt On
set Thumbwheel 1
print "        Bearing   = +321.6   Range = +  8742"
set Keyin N
set Keyin 3
set Keyin 2
set Keyin 1
set Keyin 6
set Enter On
set Keyin E
set Keyin 8
set Keyin 7
set Keyin 4
set Keyin 2
set Enter On

print "        Elevation = + 6733"
set Data_Opt On
set Keyin N
set Keyin 6
set Keyin 7
set Keyin 3
set Keyin 3
set Enter On

print "    SteerPoint 10"
set Data_Opt On
set Thumbwheel 0
print "        Bearing   = +156.3   Range = +   906"
set Keyin N
set Keyin 1
set Keyin 5
set Keyin 6
```

```
set Keyin 3
set Enter On
set Keyin E
set Keyin 9
set Keyin 0
set Keyin 6
set Enter On

print "        Elevation = +11656"
set Data_Opt On
set Keyin N
set Keyin 1
set Keyin 1
set Keyin 6
set Keyin 5
set Keyin 6
set Enter On

set Data_Opt On
set Spare_Button Off
print "**** Offset Aimpoint 1 (OAP1) Data Entry Complete"
print ""


; Step 5 of the procedures
print "**** Begin Offset Aimpoint 2 (OAP2) Data Entry"
turn Data_knob Dest
set  Aimpoint OAP2

print "    SteerPoint 0"
set Thumbwheel 0
print "        Bearing   = + 54.3   Range = +  5110"
set Keyin N
set Keyin 5
set Keyin 4
set Keyin 3
set Enter On
set Keyin E
set Keyin 5
set Keyin 1
set Keyin 1
set Keyin 0
set Enter On

print "        Elevation = +   31"
set Data_Opt On
set Keyin N
set Keyin 3
set Keyin 1
set Enter On

print "    SteerPoint 1"
set Data_Opt On
set Thumbwheel 1
print "        Bearing   = +112.9   Range = + 71234"
set Keyin N
set Keyin 1
set Keyin 1
set Keyin 2
set Keyin 9
set Enter On
set Keyin E
set Keyin 7
set Keyin 1
set Keyin 2
set Keyin 3
set Keyin 4
set Enter On

print "        Elevation = - 5612"
set Data_Opt On
set Keyin S
set Keyin 5
set Keyin 6
set Keyin 1
set Keyin 2
set Enter on

print "    SteerPoint 2"
set Data_Opt On
set Thumbwheel 2
print "        Bearing   = + 32.7   Range = +   171"
set Keyin N
set Keyin 3
set Keyin 2
set Keyin 7
set Enter On
set Keyin E
set Keyin 1
set Keyin 7
set Keyin 1
set Enter On

print "        Elevation = +  512"
set Data_Opt On
set Keyin N
set Keyin 5
set Keyin 1
set Keyin 2
set Enter On

print "    SteerPoint 3"
set Data_Opt On
set Thumbwheel 3
print "        Bearing   = + 17.2   Range = +  2426"
set Keyin N
set Keyin 1
set Keyin 7
set Keyin 2
set Enter On
set Keyin E
set Keyin 2
set Keyin 4
set Keyin 2
set Keyin 6
set Enter On

print "        Elevation = + 1672"
set Data_Opt On
set Keyin N
set Keyin 1
set Keyin 6
set Keyin 7
set Keyin 2
set Enter On

print "    SteerPoint 4"
set Data_Opt On
set Thumbwheel 4
print "        Bearing   = +289.4   Range = +  1567"
set Keyin N
set Keyin 2
set Keyin 8
set Keyin 9
set Keyin 4
set Enter On
set Keyin E
set Keyin 1
set Keyin 5
set Keyin 6
set Keyin 7
set Enter On

print "        Elevation = +   55"
set Data_Opt On
set Keyin N
set Keyin 5
set Keyin 5
set Enter On

print "    SteerPoint 5"
set Data_Opt On
set Thumbwheel 5
print "        Bearing   = +351.5   Range = +   364"
set Keyin N
set Keyin 3
set Keyin 5
set Keyin 1
set Keyin 5
set Enter On
set Keyin E
set Keyin 3
set Keyin 6
set Keyin 4
set Enter On

print "        Elevation = + 1836"
set Data_Opt On
set Keyin N
set Keyin 1
set Keyin 8
set Keyin 3
set Keyin 6
set Enter On

print "    SteerPoint 6"
set Data_Opt On
set Thumbwheel 6
print "        Bearing   = +109.7   Range = +  3476"
set Keyin N
set Keyin 1
set Keyin 0
set Keyin 9
set Keyin 7
```

```
set Enter On
set Keyin E
set Keyin 3
set Keyin 4
set Keyin 7
set Keyin 6
set Enter On

print "        Elevation = - 1007"
set Data_Opt On
set Keyin S
set Keyin 1
set Keyin 0
set Keyin 0
set Keyin 7
set Enter On

print "    SteerPoint 7"
set Data_Opt On
set Thumbwheel 7
print "        Bearing   = +195.1   Range = +  1789"
set Keyin N
set Keyin 1
set Keyin 9
set Keyin 5
set Keyin 1
set Enter On
set Keyin E
set Keyin 1
set Keyin 7
set Keyin 8
set Keyin 9
set Enter On

print "        Elevation = +  571"
set Data_Opt On
set Keyin N
set Keyin 5
set Keyin 7
set Keyin 1
set Enter On

print "    SteerPoint 8"
set Data_Opt On
set Thumbwheel 8
print "        Bearing   = +134.7   Range = +  7159"
set Keyin N
set Keyin 1
set Keyin 3
set Keyin 4
set Keyin 7
set Enter On
set Keyin E
set Keyin 7
set Keyin 1
set Keyin 5
set Keyin 9
set Enter On

print "        Elevation = + 1010"
set Data_Opt On
set Keyin N
set Keyin 1
set Keyin 0
set Keyin 1
set Keyin 0
set Enter On

print "    SteerPoint 9"
set Data_Opt On
set Thumbwheel 9
print "        Bearing   = + 18.7   Range = +  4741"
set Keyin N
set Keyin 1
set Keyin 8
set Keyin 7
set Enter On
set Keyin E
set Keyin 4
set Keyin 7
set Keyin 4
set Keyin 1
set Enter On

print "        Elevation = +23780"
set Data_Opt On
set Keyin N
set Keyin 2
set Keyin 3
set Keyin 7
set Keyin 8
set Keyin 0
set Enter On

print "    SteerPoint 19"
set Spare_Button On
print "        Bearing   = +  0.0   Range = +999999"
set Data_Opt On
set Keyin N
set Keyin 0
set Enter On
set Keyin E
set Keyin 9
set Keyin 9
set Keyin 9
set Keyin 9
set Keyin 9
set Keyin 9
set Enter On

print "        Elevation = - 1500"
set Data_Opt On
set Keyin S
set Keyin 1
set Keyin 5
set Keyin 0
set Keyin 0
set Enter On

print "    SteerPoint 18"
set Data_Opt On
set Thumbwheel 8
print "        Bearing   = +359.9   Range = +     0"
set Keyin N
set Keyin 3
set Keyin 5
set Keyin 9
set Keyin 9
set Enter On
set Keyin E
set Keyin 0
set Enter On

set Data_Opt On
print "        Elevation = +80000"
set Keyin N
set Keyin 8
set Keyin 0
set Keyin 0
set Keyin 0
set Keyin 0
set Enter On

print "    SteerPoint 17"
set Data_Opt On
set Thumbwheel 7
print "        Bearing   = + 77.8   Range = +  1732"
set Keyin N
set Keyin 7
set Keyin 7
set Keyin 8
set Enter On
set Keyin E
set Keyin 1
set Keyin 7
set Keyin 3
set Keyin 2
set Enter On

print "        Elevation = + 1299"
set Data_Opt On
set Keyin N
set Keyin 1
set Keyin 2
set Keyin 9
set Keyin 9
set Enter On

print "    SteerPoint 16"
set Data_Opt On
set Thumbwheel 6
print "        Bearing   = +146.8   Range = +    31"
set Keyin N
set Keyin 1
set Keyin 4
set Keyin 6
set Keyin 8
set Enter On
set Keyin E
set Keyin 3
set Keyin 1
set Enter On

print "        Elevation = +21356"
```

```
set Data_Opt On
set Keyin N
set Keyin 2
set Keyin 1
set Keyin 3
set Keyin 5
set Keyin 6
set Enter On

print "    SteerPoint 15"
set Data_Opt On
set Thumbwheel 5
print "        Bearing   = +241.7   Range = +  8734"
set Keyin N
set Keyin 2
set Keyin 4
set Keyin 1
set Keyin 7
set Enter On
set Keyin E
set Keyin 8
set Keyin 7
set Keyin 3
set Keyin 4
set Enter On

print "        Elevation = + 2275"
set Data_Opt On
set Keyin N
set Keyin 2
set Keyin 2
set Keyin 7
set Keyin 5
set Enter On

print "    SteerPoint 14"
set Data_Opt On
set Thumbwheel 4
print "        Bearing   = +289.4   Range = + 12367"
set Keyin N
set Keyin 2
set Keyin 8
set Keyin 9
set Keyin 4
set Enter On
set Keyin E
set Keyin 1
set Keyin 2
set Keyin 3
set Keyin 6
set Keyin 7
set Enter On

print "        Elevation = +37198"
set Data_Opt On
set Keyin N
set Keyin 3
set Keyin 7
set Keyin 1
set Keyin 9
set Keyin 8
set Enter On

print "    SteerPoint 13"
set Data_Opt On
set Thumbwheel 3
print "        Bearing   = + 93.3   Range = +   122"
set Keyin N
set Keyin 9
set Keyin 3
set Keyin 3
set Enter On
set Keyin E
set Keyin 1
set Keyin 2
set Keyin 2
set Enter On

print "        Elevation = -  178"
set Data_Opt On
set Keyin S
set Keyin 1
set Keyin 7
set Keyin 8
set Enter On

print "    SteerPoint 12"
set Data_Opt On
set Thumbwheel 2
print "        Bearing   = +307.6   Range = + 57812"
set Keyin N
set Keyin 3
set Keyin 0
set Keyin 7
set Keyin 6
set Enter On
set Keyin E
set Keyin 5
set Keyin 7
set Keyin 8
set Keyin 1
set Keyin 2
set Enter On

print "        Elevation = +75290"
set Data_Opt On
set Keyin N
set Keyin 7
set Keyin 5
set Keyin 2
set Keyin 9
set Keyin 0
set Enter On

print "    SteerPoint 11"
set Data_Opt On
set Thumbwheel 1
print "        Bearing   = +321.6   Range = +  8742"
set Keyin N
set Keyin 3
set Keyin 2
set Keyin 1
set Keyin 6
set Enter On
set Keyin E
set Keyin 8
set Keyin 7
set Keyin 4
set Keyin 2
set Enter On

print "        Elevation = + 6733"
set Data_Opt On
set Keyin N
set Keyin 6
set Keyin 7
set Keyin 3
set Keyin 3
set Enter On

print "    SteerPoint 10"
set Data_Opt On
set Thumbwheel 0
print "        Bearing   = +156.3   Range = +   906"
set Keyin N
set Keyin 1
set Keyin 5
set Keyin 6
set Keyin 3
set Enter On
set Keyin E
set Keyin 9
set Keyin 0
set Keyin 6
set Enter On

print "        Elevation = +11656"
set Data_Opt On
set Keyin N
set Keyin 1
set Keyin 1
set Keyin 6
set Keyin 5
set Keyin 6
set Enter On
set Data_Opt On
print "**** Offset Aimpoint 2 (OAP2) Data Entry Complete"
print ""


; Step 6 of the procedures
print "**** Begin Universal Transverse Mercator (UTM) Data
Entry"
turn Data_Knob Dest
set  Aimpoint DirAim
set  Spare_Button Off

print "    SteerPoint D"
print "        Lat = N73 15.7   Long = W 87 55.1"
set Thumbwheel D
set Keyin N
set Keyin 7
set Keyin 3
set Keyin 1
```

```
set Keyin 5
set Keyin 7
set Enter On

set Keyin W
set Keyin 8
set Keyin 7
set Keyin 5
set Keyin 5
set Keyin 1
set Enter On

print "        Elv = - 1099"
set Data_Opt On
set Keyin S
set Keyin 1
set Keyin 0
set Keyin 9
set Keyin 9
set Enter On

print "       UTM East/North Coordinates   East 878  North
134"
set Keyin E
set Keyin 8
set Keyin 7
set Keyin 8
set Keyin 1
set Keyin 3
set Keyin 4
set Enter On

print "    SteerPoint E"
set Data_Opt On
set Data_Opt On
set Thumbwheel E
print "        Lat = N7  43.9   Long = E161 39.9"
set Keyin N
set Keyin 7
set Keyin 4
set Keyin 3
set Keyin 9
set Enter On

set Keyin E
set Keyin 1
set Keyin 6
set Keyin 1
set Keyin 3
set Keyin 9
set Keyin 9
set Enter On

print "        Elv = + 1859"
set Data_Opt On
set Keyin N
set Keyin 1
set Keyin 8
set Keyin 5
set Keyin 9
set Enter On

print "       UTM East/North Coordinates   East 456  North
999"
set Keyin E
set Keyin 4
set Keyin 5
set Keyin 6
set Keyin 9
set Keyin 9
set Keyin 9
set Enter On

print "    SteerPoint F"
set Data_Opt On
set Data_Opt On
set Thumbwheel F
print "        Lat = S63 21.8   Long = E  0 33.3"
set Keyin S
set Keyin 6
set Keyin 3
set Keyin 2
set Keyin 1
set Keyin 8
set Enter On

set Keyin E
set Keyin 3
set Keyin 3
set Keyin 3
set Enter On

print "        Elv = +80000"
set Data_Opt On
set Keyin N
set Keyin 8
set Keyin 0
set Keyin 0
set Keyin 0
set Keyin 0
set Enter On

print "       UTM East/North Coordinates   East 000  North
735"
set Keyin E
set Keyin 7
set Keyin 3
set Keyin 5
set Enter On
print "**** Universal Transverse Mercator (UTM) Data Entry
Complete"
print ""


; Step 7 of the procedures
print "**** Begin UTM OAP1 Data Entry"
set Aimpoint OAP1

print "    SteerPoint D"
set Thumbwheel D
print "        Bearing   = +196.3   Range = + 15322"
set Keyin N
set Keyin 1
set Keyin 9
set Keyin 6
set Keyin 3
set Enter On

set Keyin E
set Keyin 1
set Keyin 5
set Keyin 3
set Keyin 2
set Keyin 2
set Enter On

print "        Elevation = - 6631"
set Data_Opt On
set Keyin S
set Keyin 6
set Keyin 6
set Keyin 3
set Keyin 1
set Enter On

print "    SteerPoint E"
set Data_Opt On
set Thumbwheel E
print "        Bearing   = + 11.5   Range = +   888"
set Keyin N
set Keyin 1
set Keyin 1
set Keyin 5
set Enter On

set Keyin E
set Keyin 8
set Keyin 8
set Keyin 8
set Enter On

print "        Elevation = +17319"
set Data_Opt On
set Keyin N
set Keyin 1
set Keyin 7
set Keyin 3
set Keyin 1
set Keyin 9
set Enter On

print "    SteerPoint F"
set Data_Opt On
set Thumbwheel F
print "        Bearing   = +  0.0   Range = +999999"
set Keyin N
set Keyin 0
set Enter On
set Keyin E
set Keyin 9
set Keyin 9
set Keyin 9
set Keyin 9
```

```
set Keyin 9
set Keyin 9
set Enter On

print "        Elevation = - 1500"
set Data_Opt On
set Keyin S
set Keyin 1
set Keyin 5
set Keyin 0
set Keyin 0
set Enter On
print "**** UTM OAP1 Data Entry Complete"
print ""



; Step 8 of the procedures
print "**** Begin UTM OAP2 Data Entry"
print "    SteerPoint D"
set Aimpoint OAP2

set Data_Opt On
set Thumbwheel D
print "        Bearing   = + 74.2   Range = + 37211"
set Keyin N
set Keyin 7
set Keyin 4
set Keyin 2
set Enter On

set Keyin E
set Keyin 3
set Keyin 7
set Keyin 2
set Keyin 1
set Keyin 1
set Enter On

print "        Elevation = +21723"
set Data_Opt On
set Keyin N
set Keyin 2
set Keyin 1
set Keyin 7
set Keyin 2
set Keyin 3
set Enter On

print "    SteerPoint E"
set Data_Opt On
set Thumbwheel E
print "        Bearing   = +247.7   Range = +  6119"
set Keyin N
set Keyin 2
set Keyin 4
set Keyin 7
set Keyin 7
set Enter On

set Keyin E
set Keyin 6
set Keyin 1
set Keyin 1
set Keyin 9
set Enter On

print "        Elevation = - 1409"
set Data_Opt On
set Keyin S
set Keyin 1
set Keyin 4
set Keyin 0
set Keyin 9
set Enter On

print "    SteerPoint F"
set Data_Opt On
set Thumbwheel F
print "        Bearing   = +359.9   Range = +     0"
set Keyin N
set Keyin 3
set Keyin 5
set Keyin 9
set Keyin 9
set Enter On

set Keyin E
set Keyin 0
set Enter On

print "        Elevation = +80000"
set Data_Opt On
set Keyin N
set Keyin 8
set Keyin 0
set Keyin 0
set Keyin 0
set Keyin 0
set Enter On

print "**** UTM OAP2 Data Entry Complete"
print ""



; Step 9 of the procedures
print "**** Begin PENGUIN Steerpoint Data Entry"
turn Data_Knob POS
turn Data_Knob DEST
set Aimpoint DirAim
set Spare_Button On

print "    SteerPoint A"
set Thumbwheel A
print "        Lat = S88 52.2   Long = E163 35.1"
set Keyin S
set Keyin 8
set Keyin 8
set Keyin 5
set Keyin 2
set Keyin 2
set Enter On

set Keyin E
set Keyin 1
set Keyin 6
set Keyin 3
set Keyin 3
set Keyin 5
set Keyin 1
set Enter On

print "        Elv = - 1500     ToT  = +214541"
set Data_Opt On   ;E/T
set Keyin S
set Keyin 1
set Keyin 5
set Keyin 0
set Keyin 0

set Enter On
set Keyin E
set Keyin 2
set Keyin 1
set Keyin 4
set Keyin 5
set Keyin 4
set Keyin 1
set Enter On

print "        Vel = + 1837    Track = +314.5"
set Data_Opt On   ;V/T
set Keyin N
set Keyin 1
set Keyin 8
set Keyin 3
set Keyin 7

set Enter On
set Keyin E
set Keyin 3
set Keyin 1
set Keyin 4
set Keyin 5
set Enter On

print "        TOD = +170845"
set Data_Opt On   ;TOD
set Keyin E
set Keyin 1
set Keyin 7
set Keyin 0
set Keyin 8
set Keyin 4
set Keyin 5
set Enter On

print "    SteerPoint B"
set Data_Opt On
set Thumbwheel B
print "        Lat = N 7 47.2   Long = E 99 46.5"
set Keyin N
set Keyin 7
```

```
set Keyin 4
set Keyin 7
set Keyin 2
set Enter On

set Keyin E
set Keyin 9
set Keyin 9
set Keyin 4
set Keyin 6
set Keyin 5
set Enter On

print "        Elv = +14667     ToT  = +180703"
set Data_Opt On
set Keyin N
set Keyin 1
set Keyin 4
set Keyin 6
set Keyin 6
set Keyin 7
set Enter On

set Keyin E
set Keyin 1
set Keyin 8
set Keyin 0
set Keyin 7
set Keyin 0
set Keyin 3
set Enter On

print "        Vel = +   15    Track = + 78.0"
set Data_Opt On
set Keyin N
set Keyin 1
set Keyin 5
set Enter On

set Keyin E
set Keyin 7
set Keyin 8
set Keyin 0
set Enter On

print "        TOD = +124503"
set Data_Opt On
set Keyin E
set Keyin 1
set Keyin 2
set Keyin 4
set Keyin 5
set Keyin 0
set Keyin 3
set Enter On

print "    SteerPoint C"
set Data_Opt On
set Thumbwheel C
print "        Lat = N29 11.4   Long = W108 18.4"
set Keyin N
set Keyin 2
set Keyin 9
set Keyin 1
set Keyin 1
set Keyin 4
set Enter On

set Keyin W
set Keyin 1
set Keyin 0
set Keyin 8
set Keyin 1
set Keyin 8
set Keyin 4
set Enter On

print "        Elv = +  723     ToT  = +032156"
set Data_Opt On
set Keyin N
set Keyin 7
set Keyin 2
set Keyin 3
set Enter On

set Keyin E
set Keyin 3
set Keyin 2
set Keyin 1
set Keyin 5
set Keyin 6
set Enter On

print "        Vel = +  758    Track = +127.7"
set Data_Opt On
set Keyin N
set Keyin 7
set Keyin 5
set Keyin 8
set Enter On

set Keyin E
set Keyin 1
set Keyin 2
set Keyin 7
set Keyin 7
set Enter On

print "        TOD = +080307"
set Data_Opt On
set Keyin E
set Keyin 8
set Keyin 0
set Keyin 3
set Keyin 0
set Keyin 7
set Enter On

print "    SteerPoint D"
set Data_Opt On
set Thumbwheel D
print "        Lat = S37 17.9   Long = W144 38.4"
set Keyin S
set Keyin 3
set Keyin 7
set Keyin 1
set Keyin 7
set Keyin 9
set Enter On

set Keyin W
set Keyin 1
set Keyin 4
set Keyin 4
set Keyin 3
set Keyin 8
set Keyin 4
set Enter On

print "        Elv = + 2654     ToT  = +193423"
set Data_Opt On
set Keyin N
set Keyin 2
set Keyin 6
set Keyin 5
set Keyin 4
set Enter On

set Keyin E
set Keyin 1
set Keyin 9
set Keyin 3
set Keyin 4
set Keyin 2
set Keyin 3
set Enter On

print "        Vel = +    0    Track = +180.0"
set Data_Opt On
set Keyin N
set Keyin 0
set Enter On

set Keyin E
set Keyin 1
set Keyin 8
set Keyin 0
set Keyin 0
set Enter On

print "        TOD = +235959"
set Data_Opt On
set Keyin E
set Keyin 2
set Keyin 3
set Keyin 5
set Keyin 9
set Keyin 5
set Keyin 9
set Enter On

print "    SteerPoint E"
set Data_Opt On
set Thumbwheel E
```

```
print "        Lat = N19 58.3   Long = E  0 00.0"
set Keyin N
set Keyin 1
set Keyin 9
set Keyin 5
set Keyin 8
set Keyin 3
set Enter On

set Keyin W
set Keyin 0
set Enter On

print "        Elv = +80000     ToT  = +000000"
set Data_Opt on
set Keyin N
set Keyin 8
set Keyin 0
set Keyin 0
set Keyin 0
set Keyin 0
set Enter On

set Keyin E
set Keyin 0
set Enter On

print "        Vel = +    3    Track = +  0.0"
set Data_Opt On
set Keyin N
set Keyin 3
set Enter On
set Keyin E
set Keyin 0
set Enter On

print "        TOD = +143721"
set Data_Opt On
set Keyin E
set Keyin 1
set Keyin 4
set Keyin 3
set Keyin 7
set Keyin 2
set Keyin 1
set Enter On

print "    SteerPoint F"
set Data_Opt On
set Thumbwheel F
print "        Lat = N 0 00.0   Long = W180 00.0"
set Keyin S
set Keyin 0
set Enter On
set Keyin W
set Keyin 1
set Keyin 8
set Keyin 0
set Keyin 0
set Keyin 0
set Keyin 0
set Enter On

print "        Elv = +  152     ToT  = +235959"
set Data_Opt On
set Keyin N
set Keyin 1
set Keyin 5
set Keyin 2
set Enter On

set Keyin E
set Keyin 2
set Keyin 3
set Keyin 5
set Keyin 9
set Keyin 5
set Keyin 9
set Enter On

print "        Vel = +32564     Track = + 31.5"
set Data_Opt on
set Keyin N
set Keyin 3
set Keyin 2
set Keyin 5
set Keyin 6
set Keyin 4
set Enter On

set Keyin E
set Keyin 3
set Keyin 1
set Keyin 5
set Enter On

print "        TOD = +000000"
set Data_Opt On
set Keyin E
set Keyin 0
set Enter On
print "**** PENGUIN Steerpoint Data Entry Complete"
print ""


; Step 11 of the procedures
print "**** Begin PENGUIN Waypoint Data Entry"
turn Data_Knob POS
turn Data_Knob DEST
set  AimPoint OAP1
set  Spare_Button On

print "    SteerPoint A"
set Thumbwheel A
print "        Lat = N73 12.9   Long = W 84 33.8"
set Keyin N
set Keyin 7
set Keyin 3
set Keyin 1
set Keyin 2
set Keyin 9
set Enter On

set Keyin W
set Keyin 8
set Keyin 4
set Keyin 3
set Keyin 3
set Keyin 8
set Enter On

print "        Elv = +17356"
set Data_Opt On
set Keyin N
set Keyin 1
set Keyin 7
set Keyin 3
set Keyin 5
set Keyin 6
set Enter On

print "    SteerPoint B"
set Data_Opt On
set Thumbwheel B
print "        Lat = N 8 53.1   Long = E137 43.0"
set Keyin N
set Keyin 8
set Keyin 5
set Keyin 3
set Keyin 1
set Enter On

set Keyin E
set Keyin 1
set Keyin 3
set Keyin 7
set Keyin 4
set Keyin 3
set Keyin 0
set Enter On

print "        Elv = -  272"
set Data_Opt On
set Keyin S
set Keyin 2
set Keyin 7
set Keyin 2
set Enter On

print "    SteerPoint C"
set Data_Opt On
set Thumbwheel C
print "        Lat = S86 13.3   Long = E109 27.2"
set Keyin S
set Keyin 8
set Keyin 6
set Keyin 1
set Keyin 3
set Keyin 3
set Enter On

set Keyin E
set Keyin 1
```

```
set Keyin 0
set Keyin 9
set Keyin 2
set Keyin 7
set Keyin 2
set Enter On

print "        Elv = + 7891"
set Data_Opt On
set Keyin N
set Keyin 7
set Keyin 8
set Keyin 9
set Keyin 1
set Enter On

print "    SteerPoint D"
set Data_Opt On
set Thumbwheel D
print "        Lat = S31 45.9   Long = W 67 57.1"
set Keyin S
set Keyin 3
set Keyin 1
set Keyin 4
set Keyin 5
set Keyin 9
set Enter On

set Keyin W
set Keyin 6
set Keyin 7
set Keyin 5
set Keyin 7
set Keyin 1
set Enter On

print "        Elv = +  183"
set Data_Opt On
set Keyin N
set Keyin 1
set Keyin 8
set Keyin 3
set Enter On

print "    SteerPoint E"
set Data_Opt On
set Thumbwheel E
print "        Lat = S90 00.0   Long = W180 00.0"
set Keyin S
set Keyin 9
set Keyin 0
set Keyin 0
set Keyin 0
set Keyin 0
set Enter On

set Keyin W
set Keyin 1
set Keyin 8
set Keyin 0
set Keyin 0
set Keyin 0
set Keyin 0
set Enter On

print "        Elv = - 1500"
set Data_Opt On
set Keyin S
set Keyin 1
set Keyin 5
set Keyin 0
set Keyin 0
set Enter On

print "    SteerPoint F"
set Data_Opt On
set Thumbwheel F
print "        Lat = N 0 00.0   Long = W  0 00.0"
set Keyin N
set Keyin 0
set Enter On
set Keyin E
set Keyin 0
set Enter On

print "        Elv = +80000"
set Data_Opt On
set Keyin N
set Keyin 8
set Keyin 0
set Keyin 0
set Keyin 0
set Keyin 0
set Enter On
set  AimPoint DirAim
set  Spare_Button Off
print "**** PENGUIN Waypoint Data Entry Complete"
print ""


; Step 12 of the procedures
print "**** Begin Route Details Data Entry"
print "    Fuel Bingo = 1173 lbs"
turn Data_Knob Cruise
set Data_Opt On
set Data_Opt On
set Data_Opt On    ;to BGO
set Keyin N
set Keyin 1
set Keyin 1
set Keyin 7
set Keyin 3
set Enter On


; Step 13 of the procedures
print "    ILS Localizer course = 162 degrees"
turn Data_Knob Misc
set Data_Opt On   ;to LOC
set Keyin N
set Keyin 1
set Keyin 6
set Keyin 2
set Enter On


; Step 14 of the procedures
print "    TACAN Bearing = 318.6 degrees"
turn Function_Knob TCN_FIX
set Keyin N
set Keyin 3
set Keyin 1
set Keyin 8
set Keyin 6
set Enter On

print "    TACAN Range = 88.5 nm"
set Keyin E
set Keyin 8
set Keyin 8
set Keyin 5
set Enter On


; Step 15 of the procedures
print "    Alignment Elevation = 2991 feet"
turn Data_Knob POS
turn Function_Knob Nav
set Data_Opt On
set Keyin N
set Keyin 2
set Keyin 9
set Keyin 9
set Keyin 1
set Enter On


; Step 16 of the procedures
print "    Above Ground Level Altitude Limit = 291 feet"
turn Data_Knob ALT_CAL
set Data_Opt On
set Data_Opt On   ;to AGL
set Keyin N
set Keyin 2
set Keyin 9
set Keyin 1
set Enter On

print "    Mean Sea Level Altitude Limit = 1063 feet"
set Data_Opt On   ;to MSL
set Keyin N
set Keyin 1
set Keyin 0
set Keyin 6
set Keyin 3
set Enter On
print "**** Route Details Data Entry Complete"
print ""
```

```
; Step 17 of the procedures
print "**** Begin Target Geometry Data Entry"
print "    VIP to target bearing = 186.7 degrees"
turn Data_Knob WPN_DEL
Data_Opt_to "VIP"
Data_opt_to "B/R"
set Keyboard on
set Keyin N
set Keyin 1
set Keyin 8
set Keyin 6
set Keyin 7

print "    VIP to Target Range = 9086 feet"
set Enter On
set Keyin E
set Keyin 9
set Keyin 0
set Keyin 8
set Keyin 6
set Enter On

print "    VIP Elevation = 13471 feet"
Data_opt_to "ELV"
set Keyin N
set Keyin 1
set Keyin 3
set Keyin 4
set Keyin 7
set Keyin 1
set Enter On

print "    Delta Bomb Range X = 491 feet"
Data_opt_to "X/Y"
set Keyin N
set Keyin 4
set Keyin 9
set Keyin 1
set Enter On

print "    Delta Bomb Range Y = 376 feet"
set Keyin E
set Keyin 3
set Keyin 7
set Keyin 6
set Enter On



; Step 18 of the procedures
print "    Target to VRP Bearing = 297.4 degrees"
Data_opt_to "VRP"
Data_opt_to "B/R"
set Keyin N
set Keyin 2
set Keyin 9
set Keyin 7
set Keyin 4
set Enter On

print "    Target to VRP Range = 8722 feet"
set Keyin E
set Keyin 8
set Keyin 7
set Keyin 2
set Keyin 2
set Enter On

print "    VRP Elevation = 7725 feet"
Data_opt_to "ELV"
set Keyin N
set Keyin 7
set Keyin 7
set Keyin 2
set Keyin 5
set Enter On

set Mode_Select On
print "    Manual Balistics Range = 6334 feet"
Data_opt_to "R/T"
set Keyin N
set Keyin 6
set Keyin 3
set Keyin 3
set Keyin 4
set Enter On

print "    Manual Balistics Time-of-Fall = 36.3 seconds"
set Keyin E
set Keyin 3
set Keyin 6
set Keyin 3
set Enter On
set Mode_Select Off



; Step 19 of the procedures
print "    Beacon to Target Bearing = 249.3 degrees"
turn Data_Knob BCN
set Keyin N
set Keyin 2
set Keyin 4
set Keyin 9
set Keyin 3
set Enter On

print "    Beacon to Target Range = 1578 feet"
set Keyin E
set Keyin 1
set Keyin 5
set Keyin 7
set Keyin 8
set Enter On

print "    Beacon to Target Elevation = -868 feet"
Data_opt_to "E/D"
set Keyin S
set Keyin 8
set Keyin 6
set Keyin 8
set Enter On

print "    Beacon Time Delay = 16.7 micro sec"
set Keyin E
set Keyin 1
set Keyin 6
set Keyin 7
set Enter On



; Step 20 of the procedures
print "    IFF Time Between Advisories = 16 minutes"
turn Data_Knob TISL
set Keyin E
set Keyin 1
set Keyin 6
set Enter On
print "**** Target Geometry Data Entry Complete"
print ""



; Step 21 of the procedures
;Do some FCC mode switching to verify that this does not
;corrupt the data entered by the test so far (it should not).

print "=====>> PERFORM MODE SWITCHING <<===== ""
print " "

set Keyboard Off
turn Data_Knob MISC
turn Data_Knob TEST
set Data_Opt On
set Data_Opt On
set Data_Opt On   ;to RDR

;Cycle Mode Sel
Toggle_Off Mode_Select 2.0

turn Data_Knob ALT_CAL

;Cycle Mode Sel
Toggle_Off Mode_Select 0.1

turn Data_Knob WPN_DEL
turn Data_Knob POS
set Data_Opt On   ;to E/A
set Mode_Select On
turn Data_Knob TISL

;Cycle Mode Sel
Toggle_Off Mode_Select 1.0

;Do this so the FCC comes up faster after power cycle
set Landing_Gear Up

;Cycle FCC power (leave it set On)
Toggle_On FCC_PWR 2.0
Wait /time = 2.0          ;Wait for FCC power to be turned on
```

```
turn Function_Knob TCN_FIX
turn Function_Knob SP
turn Function_Knob RDR_FIX
turn Function_Knob NAV
turn Function_Knob Off
turn Function_Knob NORM

turn Function_Knob NAV
set Landing_Gear Down

;depress LOAD on SCP twice
set Panel SMS
set SMS Load
set SMS Load

set Landing_Gear UP
set Master Arm


;Select following weapon modes:
;    AAM, Dogfight, LEV3, DTOS, VIP, LOFT, EOCCRP
set SMS AAM
set DGFT_MISS DGFT
set SMS OSS3
set DGFT_MISS OFF
set SMS A_G
set SMS OSS7
set SMS OSS4
set SMS OSS6
set SMS OSS4
set SMS OSS9
set SMS OSS4
set SMS OSS2
set SMS OSS4
set SMS OSS8



; Step 22 of the procedures
print " "
print " "
print "=====>> MISSION PLANNING DATA VERIFICATION <<===== ""
print " "

set Panel FCNP

turn Function_Knob Norm
turn Function_Knob Nav

Toggle_On Freeze 2.0

turn Data_Knob Dest
set  Aimpoint DirAim


print "**** Begin Steerpoint Data Verification"
set Spare_Button Off
set Thumbwheel 0
Wait /time=1.0

print "  Steerpoint  0 Data Verification"
Verify_LMD "N17417"
Verify_RMD "W118043"
set Data_Opt On
Verify_LMD "+   41"
Verify_RMD "+102337"

print "  Steerpoint  1 Data Verification"
set Thumbwheel 1
set Data_Opt On

Verify_LMD "S45548"
Verify_RMD "E102225"
set Data_Opt On
Verify_LMD "+   13"
Verify_RMD "+080706"


print "  Steerpoint  2 Data Verification"
set Thumbwheel 2
set Data_Opt On

Verify_LMD "N13237"
Verify_RMD "W 43147"
set Data_Opt On
Verify_LMD "+  323"
Verify_RMD "+010410"


print "  Steerpoint  3 Data Verification"
set Thumbwheel 3
set Data_Opt On

Verify_LMD "S67143"
Verify_RMD "W147124"
set Data_Opt On
Verify_LMD "+  452"
Verify_RMD "+023721"


print "  Steerpoint  4 Data Verification"
set Thumbwheel 4
set Data_Opt On

Verify_LMD "N13549"
Verify_RMD "E 93218"
set Data_Opt On
Verify_LMD "+ 2374"
Verify_RMD "+112135"


print "  Steerpoint  5 Data Verification"
set Thumbwheel 5
set Data_Opt On

Verify_LMD "S 8123"
Verify_RMD "E100117"
set Data_Opt On
Verify_LMD "-  782"
Verify_RMD "+112511"


print "  Steerpoint  6 Data Verification"
set Thumbwheel 6
set Data_Opt On

Verify_LMD "S65333"
Verify_RMD "W 91318"
set Data_Opt On
Verify_LMD "+ 1005"
Verify_RMD "+032154"


print "  Steerpoint  7 Data Verification"
set Thumbwheel 7
set Data_Opt On

Verify_LMD "N18210"
Verify_RMD "W121318"
set Data_Opt On
Verify_LMD "+  331"
Verify_RMD "+074536"


print "  Steerpoint  8 Data Verification"
set Thumbwheel 8
set Data_Opt On

Verify_LMD "N17376"
Verify_RMD "W113079"
set Data_Opt On
Verify_LMD "+ 1199"
Verify_RMD "+170054"


print "  Steerpoint  9 Data Verification"
set Thumbwheel 9
set Data_Opt On

Verify_LMD "N33210"
Verify_RMD "E171169"
set Data_Opt On
Verify_LMD "+ 3912"
Verify_RMD "+045009"


print "  Steerpoint  19 Data Verification"
set Thumbwheel 9
set Spare_Button On
set Data_Opt On

Verify_LMD "N89599"
Verify_RMD "W  1010"
set Data_Opt On
Verify_LMD "+    1"
Verify_RMD "+235858"


print "  Steerpoint  18 Data Verification"
set Thumbwheel 8
set Data_Opt On

Verify_LMD "S90000"
Verify_RMD "E180000"
```

```
set Data_Opt On
Verify_LMD "+    0"
Verify_RMD "+120001"


print "  Steerpoint  17 Data Verification"
set Thumbwheel 7
set Data_Opt On

Verify_LMD "N 0000"
Verify_RMD "E  0000"
set Data_Opt On
Verify_LMD "+80000"
Verify_RMD "+235959"


print "  Steerpoint  16 Data Verification"
set Thumbwheel 6
set Data_Opt On

Verify_LMD "S31444"
Verify_RMD "E 19559"
set Data_Opt On
Verify_LMD "- 1500"
Verify_RMD "+183112"


print "  Steerpoint  15 Data Verification"
set Thumbwheel 5
set Data_Opt On

Verify_LMD "S15247"
Verify_RMD "E127137"
set Data_Opt On
Verify_LMD "+ 8149"
Verify_RMD "+000000"


print "  Steerpoint  14 Data Verification"
set Thumbwheel 4
set Data_Opt On

Verify_LMD "N43066"
Verify_RMD "E  4265"
set Data_Opt On
Verify_LMD "+ 1024"
Verify_RMD "+101213"


print "  Steerpoint  13 Data Verification"
set Thumbwheel 3
set Data_Opt On

Verify_LMD "N24472"
Verify_RMD "W 21570"
set Data_Opt On
Verify_LMD "+  341"
Verify_RMD "+212103"


print "  Steerpoint  12 Data Verification"
set Thumbwheel 2
set Data_Opt On

Verify_LMD "N31163"
Verify_RMD "E114118"
set Data_Opt On
Verify_LMD "+ 6341"
Verify_RMD "+073000"


print "  Steerpoint  11 Data Verification"
set Thumbwheel 1
set Data_Opt On

Verify_LMD "S70218"
Verify_RMD "W109279"
set Data_Opt On
Verify_LMD "+12744"
Verify_RMD "+100939"


print "  Steerpoint  10 Data Verification"
set Thumbwheel 0
set Data_Opt On

Verify_LMD "N39239"
Verify_RMD "E 81416"
set Data_Opt On
Verify_LMD "-   77"
Verify_RMD "+180211"


print "**** End Steerpoint Data Verification"
print ""


; Step 23 of the procedures
print ""
print "**** Begin Steerpoint OAP1 Data Verification"
print "  Steerpoint 0 (OAP1) Data Verification"
turn Data_knob Dest
set Aimpoint OAP1
set Thumbwheel 0
set Spare_Button Off
Wait /time=1.0

Verify_LMD "+ 1126"                         ;Bearing
Verify_RMD "+  8723"                        ;Range
set Data_Opt On
Verify_LMD "-  333"                         ;Elevation


print "  Steerpoint 1 (OAP1) Data Verification"
set Thumbwheel 1
set Data_Opt On

Verify_LMD "+ 1015"                         ;Bearing
Verify_RMD "+  9913"                        ;Range
set Data_Opt On
Verify_LMD "+ 1023"                         ;Elevation


print "  Steerpoint 2 (OAP1) Data Verification"
set Thumbwheel 2
set Data_Opt On

Verify_LMD "+  327"                 ;Bearing
Verify_RMD "+   171"                ;Range
set Data_Opt On
Verify_LMD "+  512"                 ;Elevation


print "  Steerpoint 3 (OAP1) Data Verification"
set Thumbwheel 3
set Data_Opt On

Verify_LMD "+  172"                  ;Bearing
Verify_RMD "+  2426"                 ;Range
set Data_Opt On
Verify_LMD "+ 1672"                  ;Elevation


print "  Steerpoint 4 (OAP1) Data Verification"
set Thumbwheel 4
set Data_Opt On

Verify_LMD "+ 2894"                  ;Bearing
Verify_RMD "+  1567"                 ;Range
set Data_Opt On
Verify_LMD "+   55"                  ;Elevation


print "  Steerpoint 5 (OAP1) Data Verification"
set Thumbwheel 5
set Data_Opt On

Verify_LMD "+ 3515"                      ;Bearing
Verify_RMD "+   364"                     ;Range
set Data_Opt On
Verify_LMD "+ 1836"                      ;Elevation


print "  Steerpoint 6 (OAP1) Data Verification"
set Thumbwheel 6
set Data_Opt On

Verify_LMD "+ 1097"                       ;Bearing
Verify_RMD "+  3476"                      ;Range
set Data_Opt On
Verify_LMD "- 1007"


print "  Steerpoint 7 (OAP1) Data Verification"
set Thumbwheel 7
set Data_Opt On

Verify_LMD "+ 1951"                       ;Bearing
Verify_RMD "+  1789"                      ;Range
set Data_Opt On
Verify_LMD "+  571"                       ;Elevation


print "  Steerpoint 8 (OAP1) Data Verification"
```

```
set Thumbwheel 8
set Data_Opt On

Verify_LMD "+ 1347"                    ;Bearing
Verify_RMD "+  7159"                   ;Range
set Data_Opt On
Verify_LMD "+ 1010"                    ;Elevation


print "  Steerpoint 9 (OAP1) Data Verification"
set Thumbwheel 9
set Data_Opt On

Verify_LMD "+  187"                    ;Bearing
Verify_RMD "+  4741"                   ;Range
set Data_Opt On
Verify_LMD "+23780"                    ;Elevation


print "  Steerpoint 19 (OAP1) Data Verification"
set Spare_button On
set Data_Opt On

Verify_LMD "+   00"                    ;Bearing
Verify_RMD "+999999"                   ;Range
set Data_Opt On
Verify_LMD "- 1500"                    ;Elevation


print "  Steerpoint 18 (OAP1) Data Verification"
set Thumbwheel 8
set Data_Opt On

Verify_LMD "+ 3599"                    ;Bearing
Verify_RMD "+     0"                   ;Range
set Data_Opt On
Verify_LMD "+80000"                    ;Elevation


print "  Steerpoint 17 (OAP1) Data Verification"
set Thumbwheel 7
set Data_Opt On

Verify_LMD "+  778"                    ;Bearing
Verify_RMD "+  1732"                   ;Range
set Data_Opt On
Verify_LMD "+ 1299"                    ;Elevation


print "  Steerpoint 16 (OAP1) Data Verification"
set Thumbwheel 6
set Data_Opt On

Verify_LMD "+ 1468"                    ;Bearing
Verify_RMD "+    31"                   ;Range
set Data_Opt On
Verify_LMD "+21356"                    ;Elevation


print "  Steerpoint 15 (OAP1) Data Verification"
set Thumbwheel 5
set Data_Opt On

Verify_LMD "+ 2417"                    ;Bearing = + 241.7
Verify_RMD "+  8734"                   ;Range   = + 8734
set Data_Opt On
Verify_LMD "+ 2275"                    ;Elevation = + 2275


print "  Steerpoint 14 (OAP1) Data Verification"
set Thumbwheel 4
set Data_Opt On

Verify_LMD "+ 2894"                    ;Bearing
Verify_RMD "+ 12367"                   ;Range
set Data_Opt On
Verify_LMD "+37198"                    ;Elevation


print "  Steerpoint 13 (OAP1) Data Verification"
set Thumbwheel 3
set Data_Opt On

Verify_LMD "+  933"                    ;Bearing
Verify_RMD "+   122"                   ;Range
set Data_Opt On
Verify_LMD "-  178"                    ;Elevation


print "  Steerpoint 12 (OAP1) Data Verification"
set Thumbwheel 2
set Data_Opt On

Verify_LMD "+ 3076"                    ;Bearing
Verify_RMD "+ 57812"                   ;Range
set Data_Opt On
Verify_LMD "+75290"                    ;Elevation


print "  Steerpoint 11 (OAP1) Data Verification"
set Thumbwheel 1
set Data_Opt On

Verify_LMD "+ 3216"                    ;Bearing
Verify_RMD "+  8742"                   ;Range
set Data_Opt On
Verify_LMD "+ 6733"                    ;Elevation


print "  Steerpoint 10 (OAP1) Data Verification"
set Thumbwheel 0
set Data_Opt On

Verify_LMD "+ 1563"                    ;Bearing
Verify_RMD "+   906"                   ;Range
set Data_Opt On
Verify_LMD "+11656"                    ;Elevation

print "**** End Steerpoint OAP1 Data Verification"


; Step 24 of the procedures
print ""
print "**** Begin Steerpoint (OAP2) Data Verification"

print "  Steerpoint 0 (OAP2) Data Verification"
set Data_Opt On
set Spare_Button Off
turn Data_knob Dest
set Aimpoint OAP2
Wait /time=1.0

Verify_LMD "+  543"                    ;Bearing
Verify_RMD "+  5110"                   ;Range
set Data_Opt On
Verify_LMD "+   31"                     ;Elevation


print "  Steerpoint 1 (OAP2) Data Verification"
set Thumbwheel 1
set Data_Opt On

Verify_LMD "+ 1129"                    ;Bearing
Verify_RMD "+ 71234"                   ;Range
set Data_Opt On
Verify_LMD "- 5612"                 ;Elevation


print "  Steerpoint 2 (OAP2) Data Verification"
set Thumbwheel 2
set Data_Opt On

Verify_LMD "+  327"                    ;Bearing
Verify_RMD "+   171"                   ;Range
set Data_Opt On
Verify_LMD "+  512"                    ;Elevation


print "  Steerpoint 3 (OAP2) Data Verification"
set Thumbwheel 3
set Data_Opt On

Verify_LMD "+  172"                    ;Bearing
Verify_RMD "+  2426"                   ;Range
set Data_Opt On
Verify_LMD "+ 1672"                    ;Elevation


print "  Steerpoint 4 (OAP2) Data Verification"
set Thumbwheel 4
set Data_Opt On

Verify_LMD "+ 2894"                    ;Bearing
Verify_RMD "+  1567"                   ;Range
set Data_Opt On
Verify_LMD "+   55"                    ;Elevation


print "  Steerpoint 5 (OAP2) Data Verification"
set Thumbwheel 5
set Data_Opt On

Verify_LMD "+ 3515"                    ;Bearing
```

```
Verify_RMD "+   364"                    ;Range
set Data_Opt On
Verify_LMD "+ 1836"                     ;Elevation


print "  Steerpoint 6 (OAP2) Data Verification"
set Thumbwheel 6
set Data_Opt On

Verify_LMD "+ 1097"                     ;Bearing
Verify_RMD "+  3476"                    ;Range
set Data_Opt On
Verify_LMD "- 1007"                     ;Elevation


print "  Steerpoint 7 (OAP2) Data Verification"
set Thumbwheel 7
set Data_Opt On

Verify_LMD "+ 1951"                     ;Bearing
Verify_RMD "+  1789"                    ;Range
set Data_Opt On
Verify_LMD "+  571"                     ;Elevation


print "  Steerpoint 8 (OAP2) Data Verification"
set Thumbwheel 8
set Data_Opt On

Verify_LMD "+ 1347"                     ;Bearing
Verify_RMD "+  7159"                    ;Range
set Data_Opt On
Verify_LMD "+ 1010"                     ;Elevation


print "  Steerpoint 9 (OAP2) Data Verification"
set Thumbwheel 9
set Data_Opt On

Verify_LMD "+  187"                     ;Bearing
Verify_RMD "+  4741"                    ;Range
set Data_Opt On
Verify_LMD "+23780"                     ;Elevation


print "  Steerpoint 19 (OAP2) Data Verification"
set Spare_button On
set Data_Opt On

Verify_LMD "+   00"                      ;Bearing
Verify_RMD "+999999"                     ;Range
set Data_Opt On
Verify_LMD "- 1500"                      ;Elevation


print "  Steerpoint 18 (OAP2) Data Verification"
set Thumbwheel 8
set Data_Opt On

Verify_LMD "+ 3599"                      ;Bearing
Verify_RMD "+     0"                     ;Range
set Data_Opt On
Verify_LMD "+80000"                      ;Elevation


print "  Steerpoint 17 (OAP2) Data Verification"
set Thumbwheel 7
set Data_Opt On

Verify_LMD "+  778"                      ;Bearing
Verify_RMD "+  1732"                     ;Range
set Data_Opt On
Verify_LMD "+ 1299"                      ;Elevation


print "  Steerpoint 16 (OAP2) Data Verification"
set Thumbwheel 6
set Data_Opt On

Verify_LMD "+ 1468"                      ;Bearing
Verify_RMD "+    31"                     ;Range
set Data_Opt On
Verify_LMD "+21356"                      ;Elevation


print "  Steerpoint 15 (OAP2) Data Verification"
set Thumbwheel 5
set Data_Opt On

Verify_LMD "+ 2417"                      ;Bearing
Verify_RMD "+  8734"                     ;Range
set Data_Opt On
Verify_LMD "+ 2275"                      ;Elevation


print "  Steerpoint 14 (OAP2) Data Verification"
set Thumbwheel 4
set Data_Opt On

Verify_LMD "+ 2894"                      ;Bearing
Verify_RMD "+ 12367"                     ;Range
set Data_Opt On
Verify_LMD "+37198"                      ;Elevation


print "  Steerpoint 13 (OAP2) Data Verification"
set Thumbwheel 3
set Data_Opt On

Verify_LMD "+  933"                      ;Bearing
Verify_RMD "+   122"                     ;Range
set Data_Opt On
Verify_LMD "-  178"                      ;Elevation


print "  Steerpoint 12 (OAP2) Data Verification"
set Thumbwheel 2
set Data_Opt On

Verify_LMD "+ 3076"                      ;Bearing = + 307.6
Verify_RMD "+ 57812"                     ;Range   = + 57812
set Data_Opt On
Verify_LMD "+75290"                      ;Elevation = + 75290


print "  Steerpoint 11 (OAP2) Data Verification"
set Thumbwheel 1
set Data_Opt On

Verify_LMD "+ 3216"                      ;Bearing
Verify_RMD "+  8742"                     ;Range
set Data_Opt On
Verify_LMD "+ 6733"                      ;Elevation


print "  Steerpoint 10 (OAP2) Data Verification"
set Thumbwheel 0
set Data_Opt On

Verify_LMD "+ 1563"                      ;Bearing
Verify_RMD "+   906"                     ;Range
set Data_Opt On
Verify_LMD "+11656"                      ;Elevation

print "**** End Steerpoint OAP2 Data Verification "
print ""


; Steps 25 and 26 of the procedures
print "**** Begin UTM Data Verification"

; turn Data_knob Dest comment out to test
set Aimpoint DIRAIM
set Spare_Button Off

print " UTM D Data Verification "
set Thumbwheel D
Wait /time=1.0

Verify_LMD "N73157"                      ;ORG Lat  = N 73 15.7
Verify_RMD "W 87551"                     ;ORG Long = W 87 55.1
set Data_Opt On
Verify_LMD "- 1099"                      ;Elevation  = -1099
Verify_RMD "+878134"                     ;Grid Coord = 878134
set Data_Opt On
Verify_LMD "N73236"                      ;Grid Lat  = N 73 23.6
Verify_RMD "W 85104"                     ;Grid Long = W 85 10.4


print " UTM E Data Verification "
set Thumbwheel E
set Data_Opt On

Verify_LMD "N 7439"                      ;ORG Lat  = N   7 43.9
Verify_RMD "E161399"                     ;ORG Long = E 161 39.9
set Data_Opt On
Verify_LMD "+ 1859"                      ;Elevation =  1859
Verify_RMD "+456999"                      ;Grid Coord = 456999
set Data_Opt On
Verify_LMD "N 8383"                      ;Grid Lat  = N   8
38.3
Verify_RMD "E162043"                     ;Grid Long = E 162
04.3
```

```
print " UTM F Data Verification "
set Thumbwheel F
set Data_Opt On

Verify_LMD "S63218"                    ;ORG Lat  = S 63 21.8
Verify_RMD "E  0333"                   ;ORG Long = E  0 33.3
set Data_Opt On
Verify_LMD "+80000"                    ;Elevation  = 80000
Verify_RMD "+000735"                   ;Grid Coord = 000735
set Data_Opt On
Verify_LMD "S62423"                    ;Grid Lat  = S 62 42.3
Verify_RMD "E  0366"                   ;Grid Long = E  0 36.6

print "**** End UTM Data Verification"
print ""



; Step 27 of the procedures
print "**** Begin UTM OAP1 Data Verification"

print " UTM OAP1 Data D Verification "
set Aimpoint OAP1
set Spare_Button Off
set Thumbwheel D
Wait /time=1.0

Verify_LMD "+ 1963"                    ;UTM OAP1 Bearing =
196.3
Verify_RMD "+ 15322"                   ;UTM OAP1 Range   =
15322
set Data_Opt On
Verify_LMD "- 6631"                    ;UTM OAP1 Elevation =
- 6631
Verify_RMD "+    23"                   ;UTM OAP1 RMD = 23


print " UTM OAP1 Data E Verification "
set Data_Opt On
set Thumbwheel E
Wait /time=1.0

Verify_LMD "+  115"                    ;UTM OAP1 Bearing =
11.5
Verify_RMD "+   888"                   ;UTM OAP1 Range   =
888
set Data_Opt On
Verify_LMD "+17319"                    ;UTM OAP1 Elevation =
17319
Verify_RMD "+    24"                   ;UTM OAP1 RMD = 24


print " UTM OAP1 Data F Verification "
set Data_Opt On
set Thumbwheel F
Wait /time=1.0

Verify_LMD "+   00"                ;UTM OAP1 Bearing =  0.0
Verify_RMD "+999999"               ;UTM OAP1 Range   = 999999
set Data_Opt On
Verify_LMD "- 1500"                ;UTM OAP1 Elevation = -1500
Verify_RMD "+    25"               ;UTM OAP1 = 25

print "**** End UTM OAP1 Data Verification"
print ""



; Step 28 of the procedures
print "**** Begin UTM OAP2 Data Verification"

print "   UTM OAP2 Data D Verification"
set Data_Opt On
set Aimpoint OAP2
set Spare_Button Off
set Thumbwheel D
Wait /time=1.0

Verify_LMD "+  742"                ;UTM OAP2 Bearing = 74.2
Verify_RMD "+ 37211"               ;UTM OAP2 Range = 37211
set Data_Opt On
Verify_LMD "+21723"                ;UTM OAP2 Elevation = 21723
Verify_RMD "+    23"               ;UTM OAP2 RMD = 23


print " UTM OAP2 Data E Verification"
set Data_Opt On
set Thumbwheel E
Wait /time=1.0

Verify_LMD "+ 2477"                ;UTM OAP2 Bearing = 247.7
Verify_RMD "+  6119"               ;UTM OAP2 Range   =  6119
set Data_Opt On
Verify_LMD "- 1409"                ;UTM OAP2 Elevation = -1409
Verify_RMD "+    24"               ;UTM OAP2 RMD = 24


print " UTM OAP2 Data F Verification"
set Data_Opt On
set Thumbwheel F
Wait /time=1.0

Verify_LMD "+ 3599"                ;UTM OAP2 Bearing =  359.9
Verify_RMD "+     0"               ;UTM OAP2 Range = 0
set Data_Opt On
Verify_LMD "+80000"                ;UTM OAP2 Elevation = 80000
Verify_RMD "+    25"               ;UTM OAP2 RMD = 25

print "**** End UTM OAP2 Data Verification"
print ""



; Steps 29 and 30 of the procedures
print "**** Begin Penguin Steerpoint Data Verification"

print " Penguin Steerpoint A Data Verification"
set Aimpoint Diraim
set Spare_Button On
set Thumbwheel A
Wait /time=1.0

;MADE THE FOLLOWING MATCH THE INPUT VALUE SEE TEST PROC'S
Verify_LMD "S88522"                ;PSP A Latitude  =  88 52.2
Verify_RMD "E163351"               ;PSP A Longitude = 163 35.1
set Data_Opt On
Verify_LMD "- 1500"                ;PSP A Elevation = -1500
Verify_RMD "+214541"               ;PSP A TOT = 214541
set Data_Opt On
Verify_LMD "+ 1837"                ;PSP A Velocity = 1837
Verify_RMD "+  3145"               ;PSP A Track = 314.5
set Data_Opt On
Verify_RMD "+170845"               ;PSP A TOD = 170845


print " Penguin Steerpoint B Data Verification"
set Data_Opt On
set Thumbwheel B
Wait /time=1.0

Verify_LMD "N 7472"                ;PSP B Latitude  =  7 47.2
Verify_RMD "E 99465"               ;PSP B Longitude = 99 46.5
set Data_Opt On
Verify_LMD "+14667"                ;PSP B Elevations = 14667
Verify_RMD "+180703"               ;PSP B TOT = 180703
set Data_Opt On
Verify_LMD "+   15"                ;PSP B Velocity = 15
Verify_RMD "+   780"               ;PSP B Track = 78.0
set Data_Opt On
Verify_RMD "+124503"               ;PSP B TOD = 124503


print " Penguin Steerpoint C Data Verification"
set Data_Opt On
set Thumbwheel C
Wait /time=1.0

Verify_LMD "N29114"                ;PSP C Latitude  =  29 11.4
Verify_RMD "W108184"               ;PSP C Longitude = 108 18.4
set Data_Opt On
Verify_LMD "+  723"                ;PSP C Elevations = 723
Verify_RMD "+032156"               ;PSP C TOT = 032156
set Data_Opt On
Verify_LMD "+  758"                ;PSP C Velocity = 758
Verify_RMD "+  1277"               ;PSP C Track = 127.7
set Data_Opt On
Verify_RMD "+080307"               ;PSP C TOD = 080307


print " Penguin Steerpoint D Data Verification"
set Data_Opt On
set Thumbwheel D
Wait /time=1.0

Verify_LMD "S37179"                ;PSP D Latitude  =  37 17.9
Verify_RMD "W144384"               ;PSP D Longitude = 144 38.4
set Data_Opt On
Verify_LMD "+ 2654"                ;PSP D Elevations =  2654
Verify_RMD "+193423"               ;PSP D TOT = 193423
set Data_Opt On
Verify_LMD "+    0"                ;PSP D Velocity = 0
Verify_RMD "+  1800"               ;PSP D Track = 180.0
```

```
set Data_Opt On
Verify_RMD "+235959"                ;PSP D TOD = 235959


print " Penguin Steerpoint E Data Verification"
set Data_Opt On
set Thumbwheel E
Wait /time=1.0

Verify_LMD "N19583"                 ;PSP E Latitude  = 19 58.3
Verify_RMD "E  0000"                ;PSP E Longitude =  0 00.0
set Data_Opt On
Verify_LMD "+80000"                 ;PSP E Elevations = 80000
Verify_RMD "+000000"                ;PSP E TOT = 000000
set Data_Opt On
Verify_LMD "+    3"                 ;PSP E Velocity = 3
Verify_RMD "+    00"                ;PSP E Track = 0.0
set Data_Opt On
Verify_RMD "+143721"                ;PSP E TOD = 143721


print " Penguin Steerpoint F Data Verification"
set Data_Opt On
set Thumbwheel F
Wait /time=1.0

Verify_LMD "N 0000"                 ;PSP F Latitude  =   0 00.0
Verify_RMD "W180000"                ;PSP F Longitude = 180 00.0
set Data_Opt On
Verify_LMD "+  152"                 ;PSP F Elevations = 152
Verify_RMD "+235959"                ;PSP F TOT = 235959
set Data_Opt On
Verify_LMD "+32564"                 ;PSP F Velocity = 32564
Verify_RMD "+   315"                ;PSP F Track = 31.5
set Data_Opt On
Verify_RMD "+000000"                ;PSP F TOD = 000000

print "**** End Penguin Steerpoint Data Verification"
print ""



; Step 31 of the procedures
print "**** Begin Penguin Waypoint Data Verification"

print " Penguin Waypoint A Data Verification "
set Aimpoint OAP2
set Spare_Button On
set Thumbwheel A
Wait /time=1.0

Verify_LMD "N73129"                  ;PWP A Latitude  = N 73 12.9
Verify_RMD "W 84338"                ;PWP A Longitude = W 84 33.8
set Data_Opt On
Verify_LMD "+17356"                 ;PWP A Elevation = 17356
Verify_RMD "+    26"                ;PWP A Waypoint # = 26


print " Penguin Waypoint B Data Verification "
set Data_Opt On
set Thumbwheel B
Wait /time=1.0

Verify_LMD "N 8531"                 ;PWP B Latitude  = N   8 53.1
Verify_RMD "E137430"                ;PWP B Longitude = E 137 43.0
set Data_Opt On
Verify_LMD "-  272"                 ;PWP B Elevation = -272
Verify_RMD "+    27"                ;PWP B Waypoint # =  27


print " Penguin Waypoint C Data Verification "
set Data_Opt On
set Thumbwheel C
Wait /time=1.0

Verify_LMD "S86133"                 ;PWP C Latitude  = S  86 13.3
Verify_RMD "E109272"                ;PWP C Longitude = E 109 27.2
set Data_Opt On
Verify_LMD "+ 7891"                 ;PWP C Elevation = 7891
Verify_RMD "+    28"                ;PWP C Waypoint # =  28


print " Penguin Waypoint D Data Verification "
set Data_Opt On
set Thumbwheel D
Wait /time=1.0

Verify_LMD "S31459"                 ;PWP D Latitude  = S  31 45.9
Verify_RMD "W 67571"                ;PWP D Longitude = W  67 57.1
set Data_Opt On
Verify_LMD "+  183"                 ;PWP D Elevation = 183
Verify_RMD "+    29"                ;PWP D Waypoint # = 29


print " Penguin Waypoint E Data Verification "
set Data_Opt On
set Thumbwheel E
Wait /time=1.0

Verify_LMD "S90000"                 ;PWP E Latitude  = S  90 00.0
Verify_RMD "W180000"                ;PWP E Longitude = W 180 00.0
set Data_Opt On
Verify_LMD "- 1500"                 ;PWP E Elevation = -1500
Verify_RMD "+    30"                ;PWP E Waypoint # =  30


print " Penguin Waypoint F Data Verification "
set Data_Opt On
set Thumbwheel F
Wait /time=1.0

Verify_LMD "N 0000"                 ;PWP F Latitude  = N 0 00.0
Verify_RMD "E  0000"                ;PWP F Longitude = E 0 00.0
set Data_Opt On
Verify_LMD "+80000"                 ;PWP F Elevation = 80000
Verify_RMD "+    31"                ;PWP F Waypoint # =  31

set  AimPoint DirAim
set  Spare_Button Off
print "**** End Penguin Waypoint Data Verification"
print " "



; Step 32 of the procedures
print "**** Begin Route Details Data Verification"
turn Data_knob Cruise
set Data_Opt On             ; proceed to the BGO display
set Data_Opt On
set Data_Opt On

Wait /time=1.0
print " Cruise Route Data Verification "
Verify_LMD "+ 1173"         ;make sure the proper data is
                            ;displayed NOTE the test procedures
                            ;indicate the RMD but the flight
                            ;manual indicates the LMD contains
                            ;the data



; Step 33 of the procedures
turn Data_knob Misc
set Data_Opt On             ; proceed to the LOC display

Wait /time=1.0
print " Misc Route Data Verification"
Verify_LMD "+  162"         ;verify the data in the LMD


; Step 34 of the procedures
turn Function_knob  Tcn_Fix

; delay to allow the information to be displayed
Wait /time=2.0

print " Tcn Fix Route Details Data Verification"
Verify_LMD "+ 3186"
Verify_RMD "+   885"


; Step 35 of the procedures
turn Data_knob Pos
turn Function_knob Nav
set Data_Opt On

Wait /time=1.0
print " Nav Route Details Data Verification"
Verify_LMD "+ 2991"


; Step 36 of the procedures
turn Data_knob Alt_Cal
set Data_Opt On
set Data_Opt On

Wait /time=1.0
print " Alt Cal Route Details Data Verification"
Verify_LMD "+  291"
```

```
; Step 37 of the procedures
set Data_Opt On

Wait /time=1.0
print " MSL Route Details Data Verification "
Verify_LMD "+ 1063"
print "**** End Route Details Data Verification"
print " "


; Step 38 of the procedures
print "**** Begin Target Geometry Data Verification"

print " VIP B/R Target Geometry Data Verification"
turn Data_knob Wpn_Del
Data_Opt_To "VIP"
Data_Opt_To "B/R"
Wait /time=1.0
Verify_LMD "+ 1867"
Verify_RMD "+  9086"



; Step 39 of the procedures
set Data_Opt On

Wait /time=1.0
print " Elv Target Geometry Data Verification "
Verify_LMD "+13471"



; Step 40 of the procedures
set Data_Opt On

Wait /time=1.0
print " X/Y Target Geometry Data Verification "
Verify_LMD "+  491"
Verify_RMD "+   376"



; Step 41 of the procedures
set Data_Opt On
set Data_Opt On

Wait /time=1.0
print " VRP B/R Target Geometry Data Verification "
Verify_LMD "+ 2974"
Verify_RMD "+  8722"



; Step 42 of the procedures
set Data_Opt On

Wait /time=1.0
print " Elv2 Target Geometry Data Verification "
Verify_LMD "+ 7725"



; Step 43 of the procedures
set Data_Opt On
set Mode_Select On

Wait /time=1.0
print " R/T Target Geometry Data Verification "
Verify_LMD "+ 6334"
Verify_RMD "+   363"


; Step 44 of the procedures
set Mode_Select Off
turn Data_knob Bcn

Wait /time=1.0
print " BCN B/R Target Geometry Data Verification "
Verify_LMD "+ 2493"
Verify_RMD "+  1578"



; Step 45 of the procedures
set Data_Opt On

Wait /time=1.0
print " BCN E/D Target Geometry Data Verification "
Verify_LMD "-  868"
Verify_RMD "+   167"


; Step 46 of the procedures
turn Data_knob Tisl

Wait /time=1.0
print " Tisl Target Geometry Data Verification "
Verify_RMD "+    16"

print "**** End Target Geometry Data Verification"



;
; step 47 is used to check data on a dss system
;



; step 48 Mission Planning Test
print ""
print "**** Verify Selected Functions"

set SMS_PWR On              ; Select Power on Mode for the SCP
set Landing_Gear Down       ; ie Gear up off
turn Data_Knob Dest
set Aimpoint DIRAIM
set Spare_Button Off
set Thumbwheel 4

; select the keyboard to allow data entry
set Keyboard On

; enter the coordinates S 47 39.6 W 173 13.7
set Keyin S
set Keyin 4
set Keyin 7
set Keyin 3
set Keyin 9
set Keyin 6
set Enter On

set Keyin W
set Keyin 1
set Keyin 7
set Keyin 3
set Keyin 1
set Keyin 3
set Keyin 7
set Enter On
set Keyboard Off

turn Data_Knob Wpn_Del

; cycle FCC power
Toggle_On FCC_Pwr 2.0
Wait /time = 20.0

turn Data_Knob Dest
wait /time=1.0

; verify the data on the displays
print "**** Cycle Power Geometry Data Verification "
Verify_LMD "S47396"                ;Latitude  = S  47 39.6
Verify_RMD "W173137"               ;Longitude = W 173 13.7



; step 49
set Panel FCNP
set Landing_Gear Up
set Mark On
Verify_Alpha_Display "MKA"

set Mark On
Verify_Alpha_Display "MKB"

set Mark On
Verify_Alpha_Display "MKC"



; Step 50
print "**** Start Aircraft Flying to verify mark points"
; Select the MKC rotary option **********************
set Thumbwheel C
set Freeze Off

; set the airspeed and an altitude to climb to, and fly
aircraft
AIRSPEED 400
ALTITUDE 5000
```

```
        HEADING 030
        Wait /time = 20.0

        ; finished flying the aircraft
        set Freeze On

        turn Data_Knob Pos

        ; Record/Save the present aircraft position
        ; The following statements will save values for later
comparison
        ; Save the LMD Values
        Wait /time=1.0
        Mem_Copy IF04_2  Mission_Planning_1
        Mem_Copy IF04_5  Mission_Planning_2
        Mem_Copy IF04_6  Mission_Planning_3

        ; Save the RMD Values
        Mem_Copy IF04_4  Mission_Planning_4
        Mem_Copy IF04_7  Mission_Planning_5
        Mem_Copy IF04_8  Mission_Planning_6

        ; Translate leading zeroes into blanks if present in either
display
LMDA:   Check/No_Report Mission_Planning_2 = 0 000F
          Jump RMDA
        or Mission_Planning_2 000F ; change msd of LMD to blank

RMDA:   Check/No_Report Mission_Planning_5 = 0 00F0
          Jump RMDA2
        or Mission_Planning_5 00F0 ; change msd of RMD to blank

        Check/No_Report Mission_Planning_5 = 0 000F
          Jump RMDA2
        or Mission_Planning_5 000F ; change 4th lsd of LMD to blank

RMDA2:  nop

        set Mark On
        Verify_Alpha_Display "MKA"



        ;Step 51 -- Fly the aircraft a little more.
        set Freeze Off
        Wait /time=10.0
        set Freeze On

        turn Data_Knob Pos

        ; Record/Save the Present Position

        ; The following statements will save values for later
        ; comparison.

        ; Save the LMD Values
        Wait /time=1.0
        Mem_Copy IF04_2  Mission_Planning_7
        Mem_Copy IF04_5  Mission_Planning_8
        Mem_Copy IF04_6  Mission_Planning_9

        ; Save the RMD Values
        Mem_Copy IF04_4  Mission_Planning_10
        Mem_Copy IF04_7  Mission_Planning_11
        Mem_Copy IF04_8  Mission_Planning_12


        ; Translate leading zeroes into blanks if present in
        ; either display
LMDB:   Check/No_Report Mission_Planning_8 = 0 000F
          Jump RMDB
        or Mission_Planning_8 000F ; change msd of LMD to blank

RMDB:   Check/No_Report Mission_Planning_11 = 0 00F0
          Jump RMDB2
        or Mission_Planning_11 00F0 ; change msd of RMD to blank

        Check/No_Report Mission_Planning_11 = 0 000F
          Jump RMDB2
        or Mission_Planning_11 000F ; change 4th lsd of LMD to blank

RMDB2:  nop

        set Mark On
        Verify_Alpha_Display "MKB"



        ; Step 52 -- Fly the aircraft somemore.
        set Freeze Off
        Wait /time=10.0
        set Freeze On

        turn Data_Knob Pos

        ; Record/Save the Present Position
        ; The following statements will save values for later
        ; comparison

        ; Save the LMD Values
        Wait /time=1.0
        Mem_Copy IF04_2  Mission_Planning_13
        Mem_Copy IF04_5  Mission_Planning_14
        Mem_Copy IF04_6  Mission_Planning_15

        ; Save the RMD Values
        Mem_Copy IF04_4  Mission_Planning_16
        Mem_Copy IF04_7  Mission_Planning_17
        Mem_Copy IF04_8  Mission_Planning_18

        ; Translate leading zeroes into blanks if present in either
        ; display
LMDC:   Check/No_Report Mission_Planning_14 = 0 000F
          Jump RMDC
        or Mission_Planning_14 000F ; change msd of LMD to blank

RMDC:   Check/No_Report Mission_Planning_17 = 0 00F0
          Jump RMDC2
        or Mission_Planning_17 00F0 ; change msd of RMD to blank

        Check/No_Report Mission_Planning_17 = 0 000F
          Jump RMDC2
        or Mission_Planning_17 000F ; change 4th lsd of LMD to blank

RMDC2:  nop

        set Mark On
        Verify_Alpha_Display "MKC"



        ; Step 53 -- Reset the simulation
        ; Note: the next three steps test that the LMD & RMD are equal
to the
        ;   saved values.  The actual OFP test specifies they must be
within
        ;   +/- .1
        set ICMode On
        wait /time=2.0
        turn Data_Knob Dest
        set Thumbwheel A
        wait /time=2.0

        ; The following statements verify the values which are
        ; displayed in the LMD & RMD against previously saved values

        ; check the left display

        Mem_Check IF04_2 = Mission_Planning_1 0001
          Jump NE_LMDA
        Mem_Check IF04_5 = Mission_Planning_2 000F
          Jump NE_LMDA
        Mem_Check IF04_6 = Mission_Planning_3 0FFFF
          Jump NE_LMDA
        Print_Msg "Thumbwheel A LMD Verification" PASS
        Jump Vfy_RMDA

NE_LMDA: Print_Msg "Thumbwheel A LMD Verification" FAIL


        ; check the right display
Vfy_RMDA: Nop
        Mem_Check IF04_4 = Mission_Planning_4 0001
          Jump NE_RMDA
        Mem_Check IF04_7 = Mission_Planning_5 00FF
          Jump NE_RMDA
        Mem_Check IF04_8 = Mission_Planning_6 0FFFF
          Jump NE_RMDA
        Print_Msg "Thumbwheel A RMD Verification" PASS
        Jump Vfy_LMDB

NE_RMDA: Print_Msg "Thumbwheel A RMD Verification" FAIL



        ; Step 54
Vfy_LMDB:  Nop
        set Thumbwheel B
        wait /time=2.0

        ; The following statements verify the values which are
        ; displayed in the LMD & RMD against previously saved values

        ; check the left display
```

```
        Mem_Check IF04_2 = Mission_Planning_7 0001
          Jump NE_LMDB
        Mem_Check IF04_5 = Mission_Planning_8 000F
          Jump NE_LMDB
        Mem_Check IF04_6 = Mission_Planning_9 0FFFF
          Jump NE_LMDB
        Print_Msg "Thumbwheel B LMD Verification" PASS
        Jump Vfy_RMDB

NE_LMDB: Print_Msg "Thumbwheel B RMD Verification" FAIL


        ; check the right display
Vfy_RMDB:  Nop
        Mem_Check IF04_4 = Mission_Planning_10 0001
          Jump NE_RMDB
        Mem_Check IF04_7 = Mission_Planning_11 00FF
          Jump NE_RMDB
        Mem_Check IF04_8 = Mission_Planning_12 0FFFF
          Jump NE_RMDB
        Print_Msg "Thumbwheel B RMD Verification" PASS
        Jump Vfy_LMDC

NE_RMDB: Print_Msg "Thumbwheel B RMD Verification" FAIL


        ; Step 55
Vfy_LMDC:  Nop
        set Thumbwheel C
        wait /time=2.0

        ; The following statements verify the values which are
displayed
        ; in the LMD & RMD against previously saved values
        ; check the left display

        Mem_Check IF04_2 = Mission_Planning_13 0001
          Jump NE_LMDC
        Mem_Check IF04_5 = Mission_Planning_14 000F
          Jump NE_LMDC
        Mem_Check IF04_6 = Mission_Planning_15 0FFFF
          Jump NE_LMDC
        Print_Msg "Thumbwheel C LMD Verification" PASS
        Jump Vfy_RMDC

NE_LMDC: Print_Msg "Thumbwheel C LMD Verification" FAIL


        ; check the right display
Vfy_RMDC:  Nop
        Mem_Check IF04_4 = Mission_Planning_16 0001
          Jump NE_RMDC
        Mem_Check IF04_7 = Mission_Planning_17 00FF
          Jump NE_RMDC
        Mem_Check IF04_8 = Mission_Planning_18 0FFFF
          Jump NE_RMDC
        Print_Msg "Thumbwheel C RMD Verification" PASS
        Jump FIN_MD

NE_RMDC: Print_Msg "Thumbwheel C RMD Verification" FAIL
FIN_MD:  Nop


END_FILE: print ">>>>> MISSION PLANNING COMPLETED <<<<<"
          print " "
          print " "
```

THIS PAGE INTENTIONALLY LEFT BLANK

Appendix C

30.0 TESTMASTER™ EFSM DIAGRAMS AND DOCUMENTATION

30.1 Modeled Scenarios.

Scenario_1

This scenario enters data into each Mission Plan Type (Steerpoints, OAP1, OAP2, UTM coords, Penguin steerpoints, Penguin waypoints), verifies the data, takes off and flies for 10 seconds, and then verifies the data again.

Scenario_2

This scenario performs an OFP Identification and enters the following data:

Mission Planning Data:
- Steerpoints
- Offset Aimpoints1
- Offset Aimpoints2
- UTM Coordinates
- Penguin Steerpoints
- Penguin Waypoints

Route Details Data:
- Energy Management Data (Fuel Bingo)
- Altitude Calibration Data (Altitude limits, Automatic DVAL Calibration)
- ILS Localizer Data

Target Geometry Data:
- IFF Advisory Data
- Beacon/VIP/VRP Data
- TACAN Data
- Manual Ballistics Data

The previous data entered is verified, the aircraft takes off and flies for 10 seconds, the data is verified again, and Mark points are set and then verified.

Scenario_3

This scenario performs an OFP Identification and enters the following data:

Route Details Data:
- Energy Management Data (Fuel Bingo)
- Altitude Calibration Data (Altitude limits, Automatic DVAL Calibration)
- ILS Localizer Data

Target Geometry Data:
- IFF Advisory Data
- Beacon/VIP/VRP Data
- TACAN Data
- Manual Ballistics Data

The previous data entered is verified, the aircraft takes off and flies for 10 seconds, the data is verified again.

Scenario_4

This scenario takes off and flies for 10 seconds, sets Mark points and then verifies them.

30.2 TestMaster™ Pilot Program Models.

Model	Functionality
Air_to_Air	Empty shell. Available for expansion to include all air-to-air related functions.
Air_to_Ground	Available for expansion to include all air-to-ground functions. Currently includes only verification of previously set Mark points.
Altitude_Calibration	Provides functions necessary to perform an automatic DVAL calibration, manual DVAL calibration, and to set altitude limits.
Altitude Limit	Performs function necessary to enter or verify AGL and/or MSL altitude limits.
Auto_DVAL_Cal	Performs function necessary to enter or verify data for an automatic DVAL calibration.
Beacon_Mode	Performs function necessary to enter or verify Beacon data.
Beacon_VIP_VRP	Provides functions necessary to enter Beacon time delay, VIP offset, and VRP offset data.
Energy_Mgmt_Setup	Provide functions necessary to input Bingo fuel values and to select home steerpoint.
Enter_OAP1_Data	Enters or verifies the offset aimpoint data (i.e., bearing, el, range) in a random order for the current location. (Currently allows input into locations 0 - 4).

Model	Functionality
Enter_OAP2_Data	Enters or verifies the offset aimpoint data (i.e., bearing, el, range) in a random order for the current location. (Currently allows input into locations 0 - 4).
Enter_Peng_stps	Enters or verifies the Penguin steerpoint data (i.e., lat, long, el, TOT, tgt vel, tgt trk, TOD) in a random order for the current location. (Currently allows input into locations A - C (20-22)).
Enter_Peng_waypt1_Data	Enters or verifies the Penguin waypoint 1 data (i.e., lat, long, el) in a random order for the current location. (Currently allows input into locations A - C (20-22)).
Enter_Peng_waypt2_Data	Enters or verifies the Penguin waypoint 2 data (i.e., lat, long, el) in a random order for the current location. (Currently allows input into locations A - C (20-22)).
Enter_Stpt_Data	Enters or verifies the steerpoint data (i.e., lat, long, el, TOT) in a random order for the current location. (Currently allows input into locations 0 - 4).
Enter_UTM_Coords	Enters or verifies the UTM coord data (i.e., lat, long, el, UTM coord) in a random order for the current location. (Currently allows input into locations D - F (23-25)).
FCNP_Switching	Randomly switches function knob, data knob, mode select, and data opt on the FCNP and cycles FCC power.
Flight	Provides basic functions necessary for the aircraft to fly as well as performs FCNP switching and data verification.
Flight_Setup	Declares variables necessary to have the aircraft fly.

Model	Functionality
Fuel_Bingo	Performs function necessary to enter or verify bingo fuel values.
Home_Stpt_Selection	Empty shell. Available for expansion to perform functions necessary to enter home steerpoint selection.
IFF_Advisories	Provides functions necessary to enter IFF advisory data.
ILS_Localizer	Provides functions necessary to enter an ILS localizer course.
INU_Ground_Alignment	Empty shell. Available for expansion to provide functions necessary to align the NU.
Initialize_PreFlight	Tells Nav_Panel to turn on FCC power.
Keypad	Empty shell. Available for actions related to using FCNP keypad. Currently use macros for data entry rather than specific keypad presses.
Landing	Empty shell. Available for expansion to provide functions necessary for the aircraft to land.
Landing_Setup	Available to declare variables necessary to have the aircraft land.
MFL_Clearing	Empty shell. Available for expansion to provide functions necessary to clear the MFL.
Manual_Ballistics	Provides functions necessary to enter manual ballistics data.
Manual_DVAL_Cal	Empty shell. Available for expansion to perform function necessary to enter or verify data for a manual DVAL calibration.
Mission_Plan_Setup	Directs path through models declaring variables necessary for performing mission planning functions.

Model	Functionality
Mission_Planning	Directs path to specified Mission Plan Types 1 through x in a random order. Sets function parameter to be sent to Nav_Panel.
Nav_Data_Knob	Allows 1 of 12 positions to be set as determined by the desired function.
Nav_Data_Switches	Allows Spare, DIR AIM, OAP1, and OAP2 to be set as determined by the desired function and location to be entered.
Nav_Function_Knob	Allows 1 of 12 positions to be set as determined by the desired function.
Nav_Panel	Provides access to all knobs and switches residing on the FCNP. Manipulation of these knobs and switches is determined by the function type passed by the leading transition.
OAP1_Data_Setup	Declares Offset Aimpoint 1 data variables (i.e., bearing, el, range).
OAP2_Data_Setup	Declares Offset Aimpoint 2 data variables (i.e., bearing, el, range).
OFP_ID	Performs identification of the FCC and AIFF OFPs through use of the FCNP.
Offset_Aimpoints1	Tells Nav_Panel the offset aimpoint location in which the data is to be entered, and then directs it to be entered. Repeats this process for the specified number of locations to be entered (currently in a sequential order).
Offset_Aimpoints2	Tells Nav_Panel the offset aimpoint location in which the data is to be entered, and then directs it to be entered. Repeats this process for the specified number of locations to be entered (currently in a sequential order).
Peng_Stpt_Data_Setup	Declares Penguin steerpoint data variables (i.e., lat, long, el, TOT, tgt vel, tgt trk, TOD).

Model	Functionality
Peng_Waypt_Data_Setup	Declares Penguin Waypoint 1 and Waypoint 2 data variables (i.e., lat, long, el).
Penguin_Steerpoints	Tells the Nav_Panel the Penguin steerpoint location in which the data is to be entered, and then directs it to be entered. Repeats this process for the specified number of locations to be entered (currently in a sequential order).
Penguin_Waypoints1	Tells the Nav_Panel the Penguin waypoint location in which the data is to be entered, and then directs it to be entered. Repeats this process for the specified number of locations to be entered (currently in a sequential order).
Penguin_Waypoints2	Tells the Nav_Panel the Penguin waypoint location in which the data is to be entered, and then directs it to be entered. Repeats this process for the specified number of locations to be entered (currently in a sequential order).
PreFlight	Directs preflight data entry through the FCNP. Allows performance of one or many of the available preflight activities based on the flags set in the desired Scenario.
Route_Details_Setup	Declares Route Details data variables (i.e., bingo fuel, alignmentel, etc.)
SMS	Empty shell. Available for expansion to provide functions necessary to enter Stores Management info.
Scenario_Setup	Allows different scenario models to be set up and chosen to generate a particular type of test. Defines a portion of the static variables needed to define scenarios.
Scenario_'x'	Defines desired functions to be performed and data necessary to perform them.

Model	Functionality
Set_Mark_A	Performs the function of setting Mark point A.
Set_Mark_B	Performs the function of setting Mark point B.
Set_Mark_C	Performs the function of setting Mark point C.
Set_Mark_Points	Provides functions necessary to set Mark points.
Steerpoints	Tells Nav_Panel the steerpoint location in which the data is to be entered, and then directs it to be entered. Repeats this process for the specified number of locations to be entered (currently in a sequential order).
Stpt_Data_Setup	Declares steerpoint data variables (i.e., lat, long, el, TOT).
TACAN	Provides functions necessary to enter TACAN data.
TakeOff	Provides basic functions necessary for the aircraft to take off.
TakeOff_Setup	Declares variables necessary to have the aircraft take off.
Target_Geometry_Setup	Declares Target Geometry data variables (i.e., TACAN bearing/range, VIP bearing/range/el/delta x/delta y, etc.)
Thumbwheel_Position	Allows 1 of 16 positions to be set as determined by the desired function and location to be entered.
UTM_Coords	Tells Nav_Panel the UTM coord location in which the data is to be entered, and then directs it to be entered. Repeats this process for the specified number of locations to be entered (currently in a sequential order).

Model	Functionality
UTM_Data_Setup	Declares computer derived UTM grid lats/longs. Should declare all UTM data variables (i.e., lat, long, el, UTM coords). These variables are currently declared in Scenario_Setup.
VTS_Cleanup	Empty shell. Available to provide functions necessary to end the VTS session.
VTS_Setup	Provides test information necessary to setup the VTS with the proper initialization files.
Verify_Data_Setup	Declares variables necessary to perform verify functions.
Verify_Mark_A	Performs function of verifying that the data displayed on the LMD and RMD are the same as those stored in memory when Mark A was set.
Verify_Mark_B	Performs function of verifying that the data displayed on the LMD and RMD are the same as those stored in memory when Mark B was set.
Verify_Mark_C	Performs function of verifying that the data displayed on the LMD and RMD are the same as those stored in memory when Mark C was set.
Verify_Mark_Points	Provides functions necessary to verify Mark points.
Verify_PreFlight_Actions	Directs verification of preflight data input through the FCNP. Allows verification of one or many of the available preflight activities based on the flags set in the desired Scenario. Follows same paths as in entering of data except verify flags are set.
Visual_Initial_Point	Performs function necessary to enter or verify VIP data.
Visual_Release_Point	Perfoms function necessary to enter or verify VRP data.

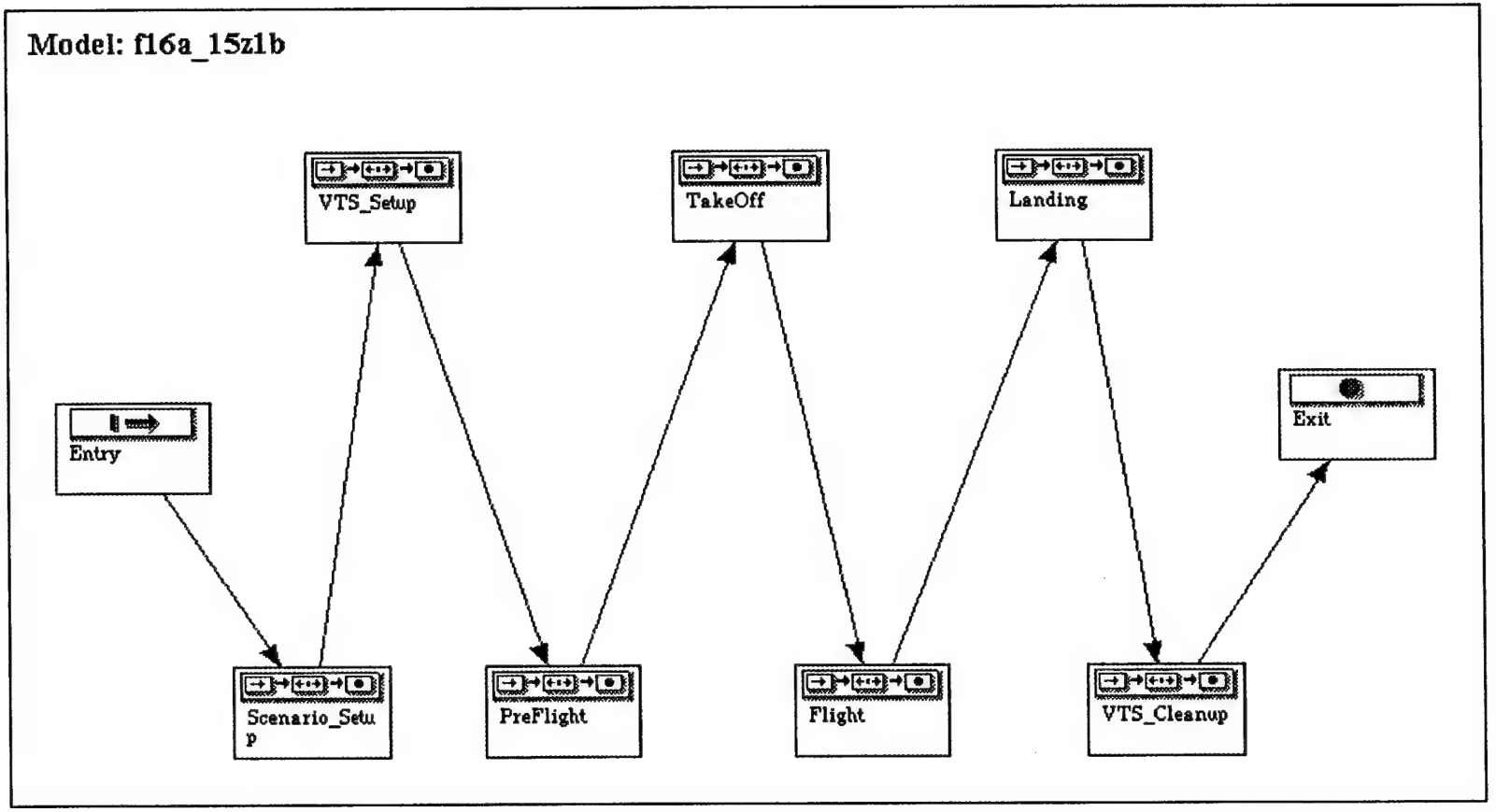
Model	Functionality
f16a_15z1b	Top level of model. Defines F-16 mission scenario by major mission sections.

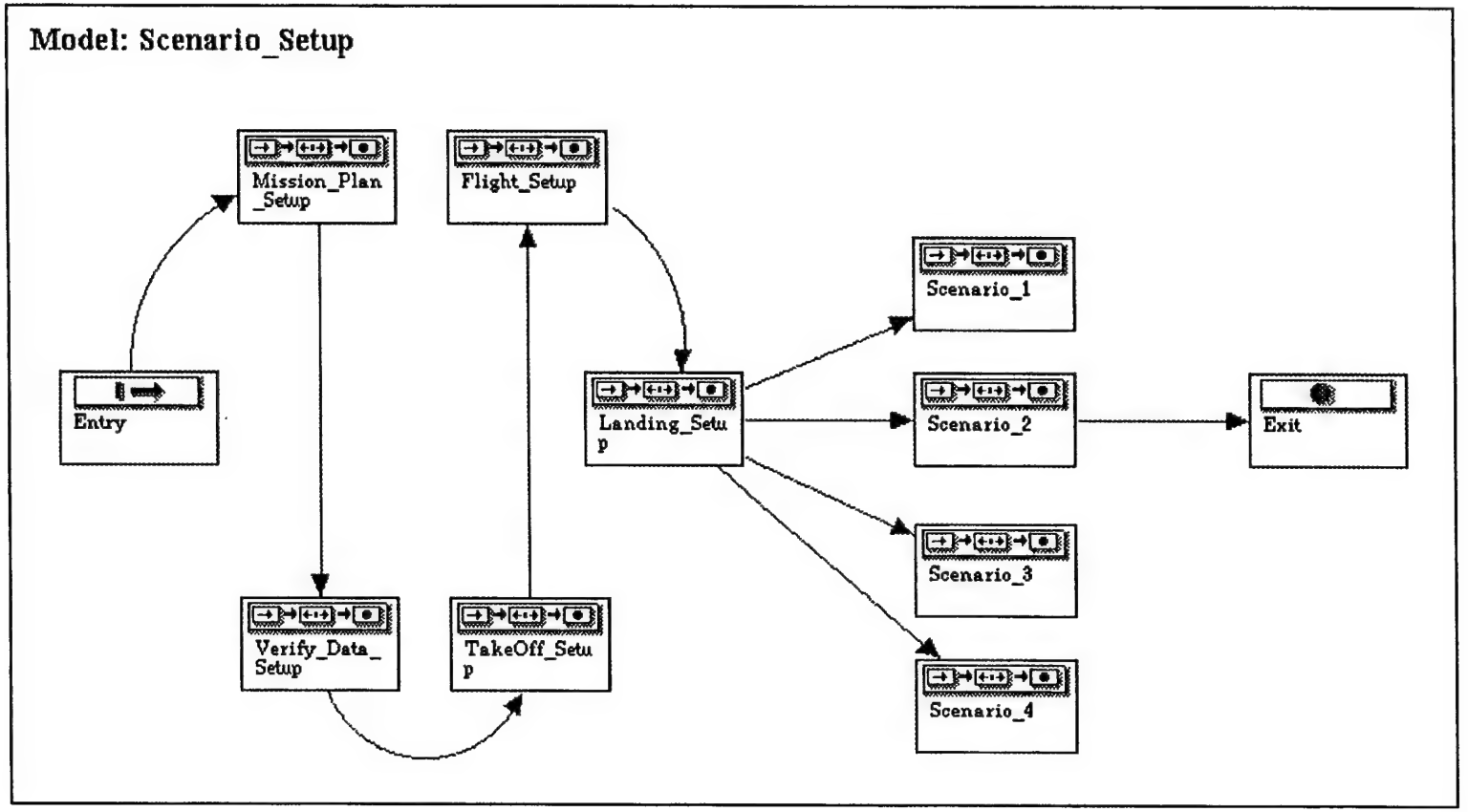
Summary of F-16A/B Block15Z1B Model Statistics

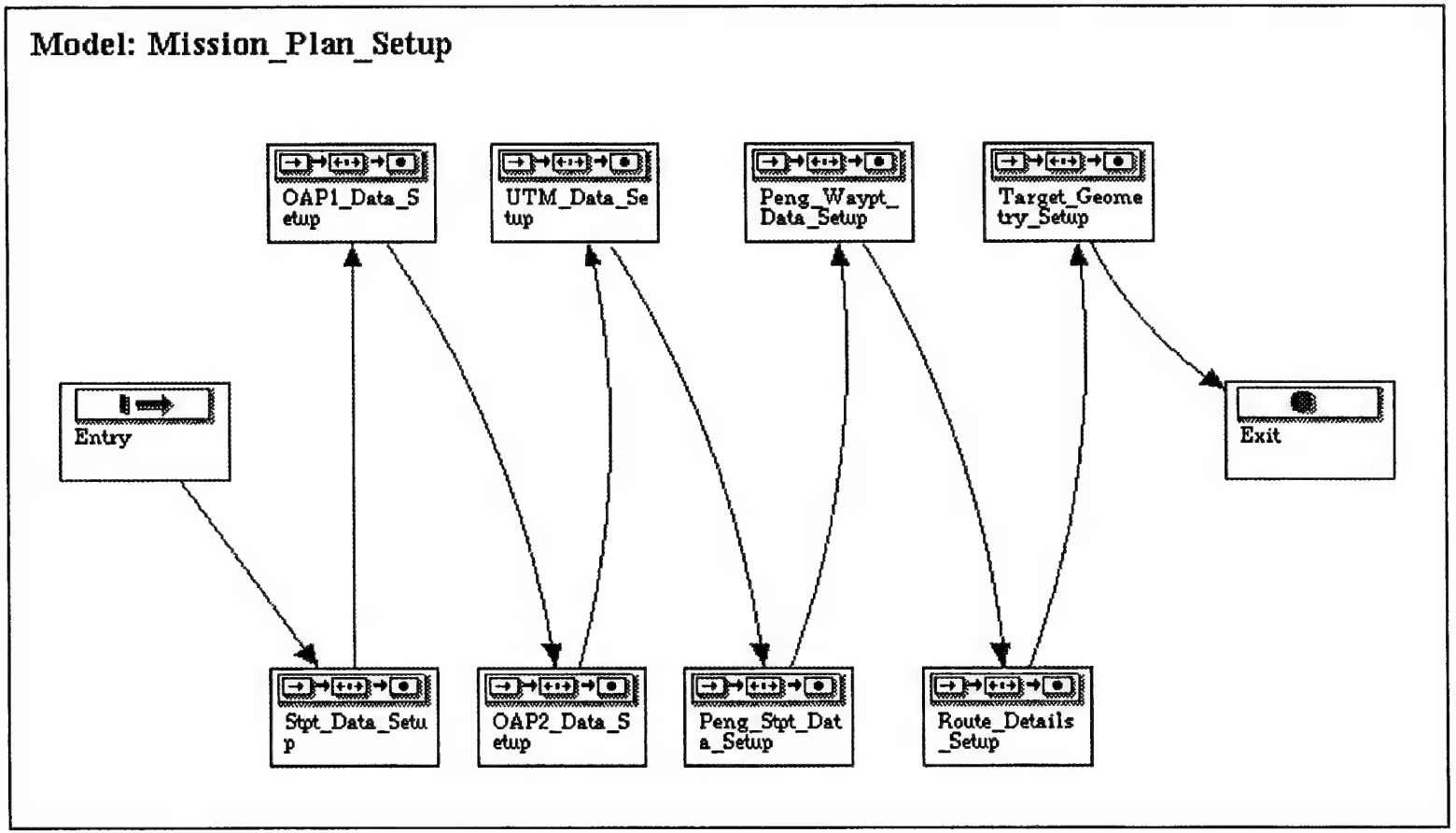
Model Count	
Functional Models:	57
Empty Shells:	9
Variable Declaration Models:	12
Total:	78

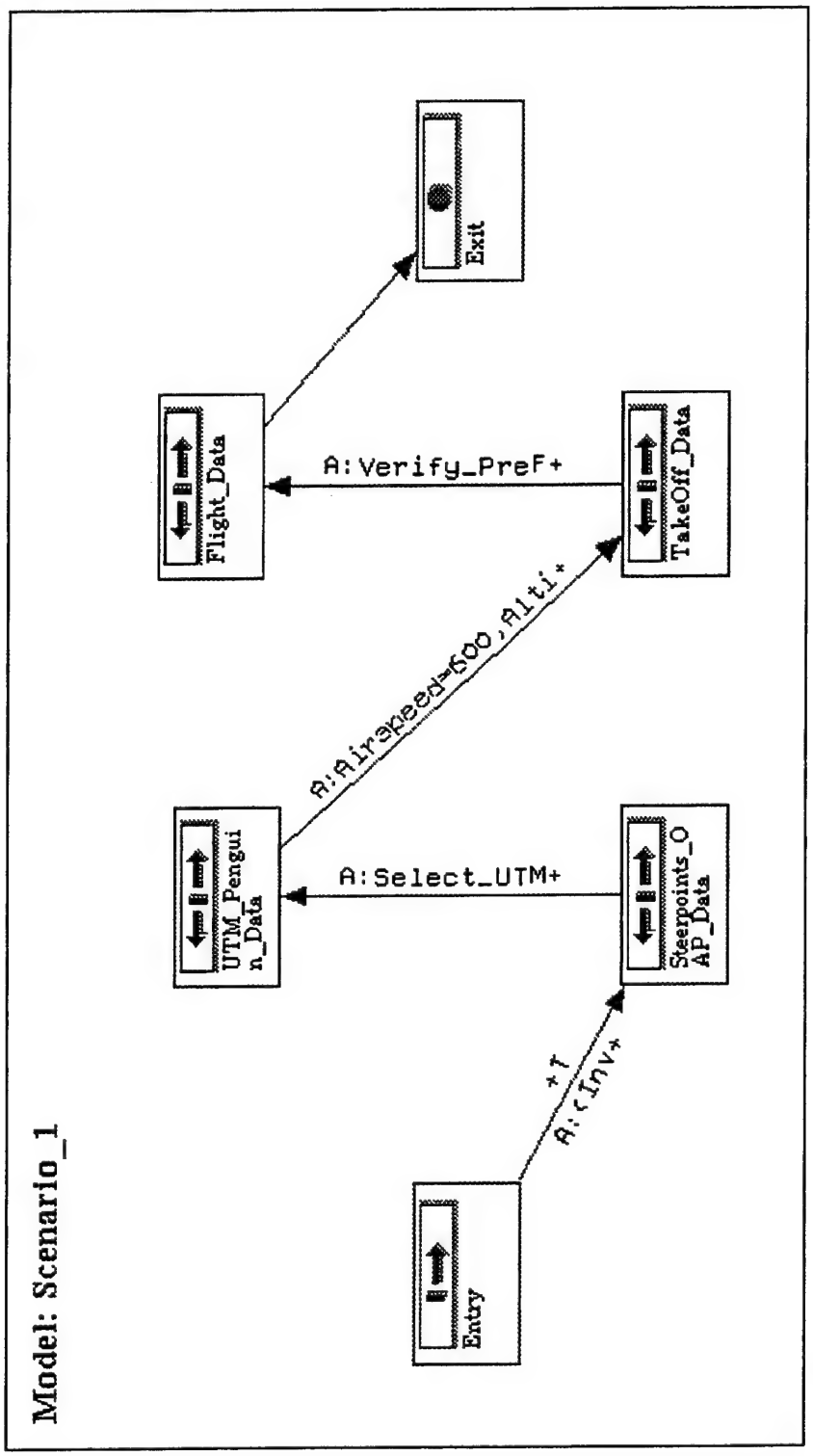
Variable Count	
Variables Declared:	237
Additional variables needed to enter data into all Mission Plan Type locations:	213

THIS PAGE INTENTIONALLY LEFT BLANK

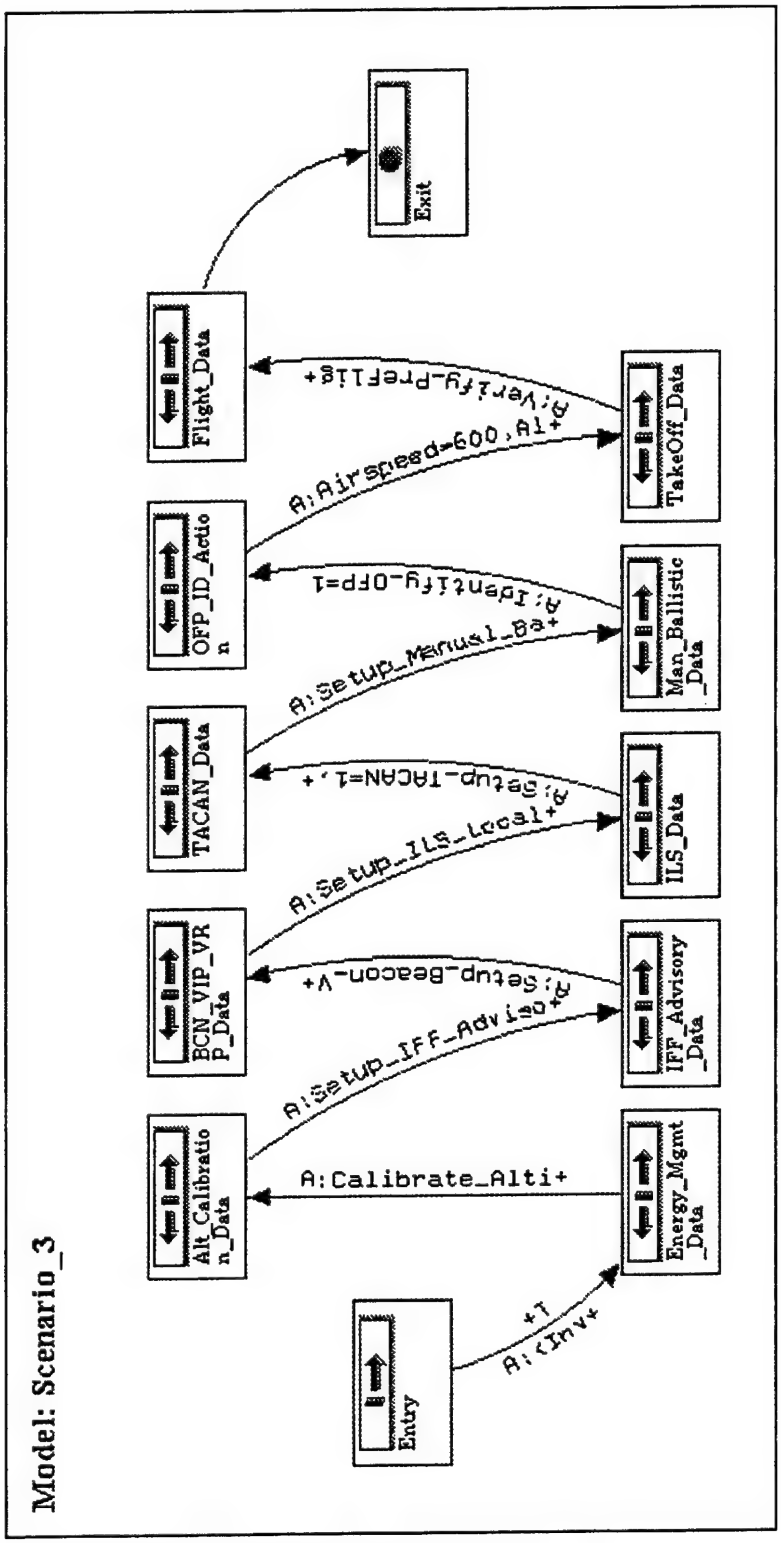

Model: f16a_15z1b
VTS_Setup
TakeOff
Landing
Entry
Exit
Scenario_Setu
p
PreFlight
Flight
VTS_Cleanup

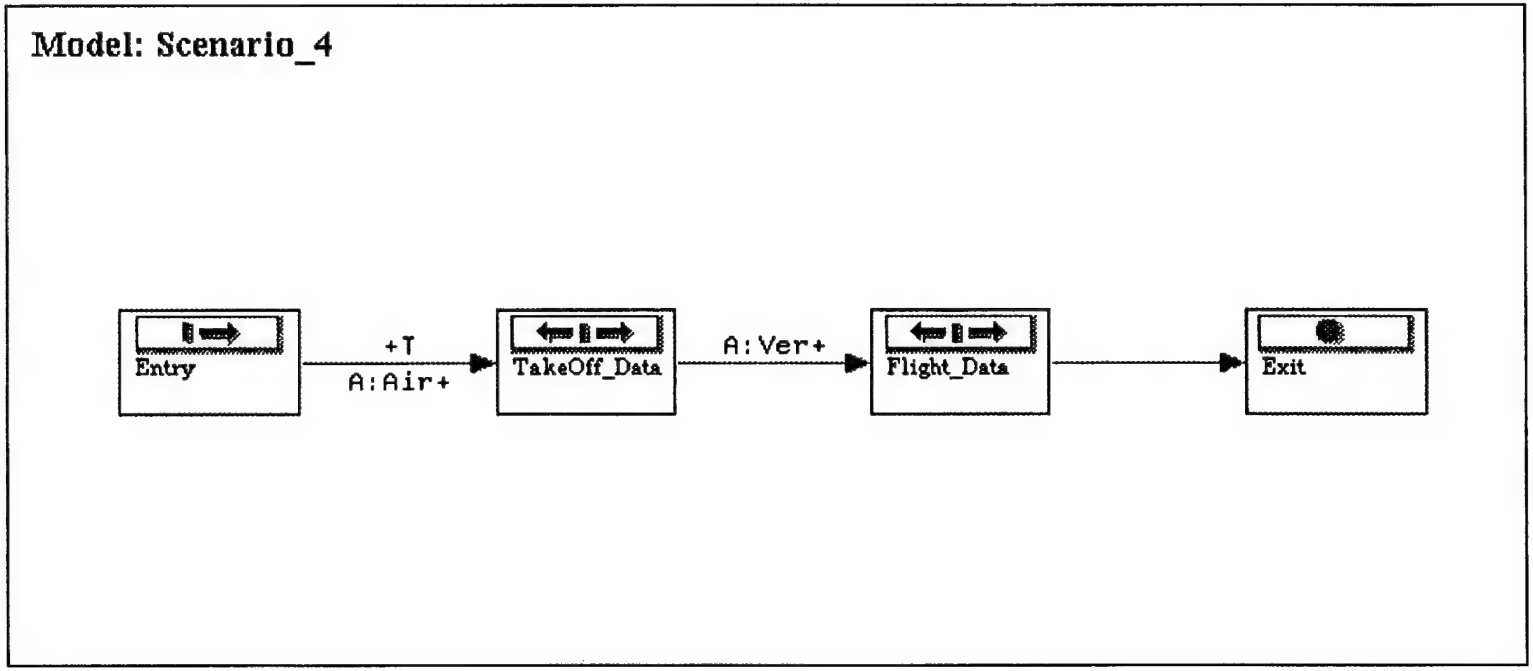

Model: Scenario_Setup
Mission_Plan
_Setup
Flight_Setup
Entry
Landing_Setu
p
Scenario_1
Scenario_2
Exit
Scenario_3
Scenario_4
Verify_Data_
Setup
TakeOff_Setu
p

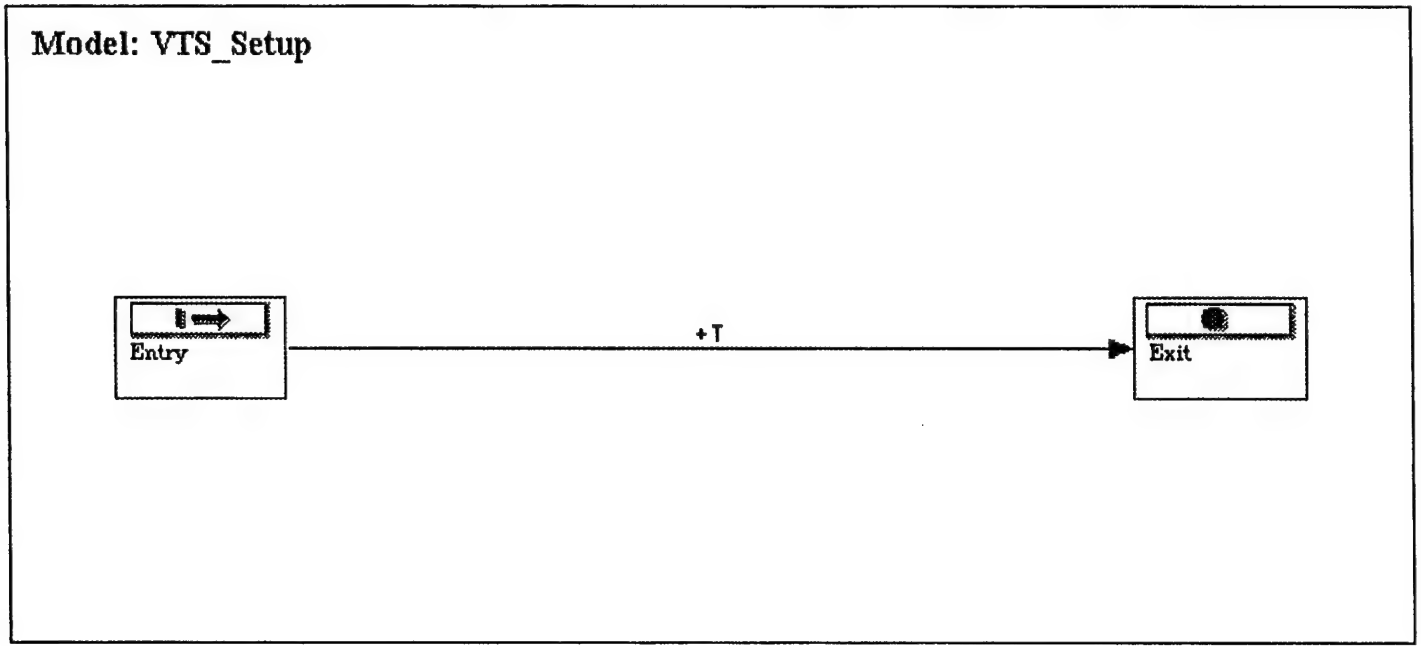

Model: Mission_Plan_Setup
OAP1_Data_Setup
UTM_Data_Setup
Peng_Waypt_Data_Setup
Target_Geometry_Setup
Entry
Exit
Stpt_Data_Setup
OAP2_Data_Setup
Peng_Stpt_Data_Setup
Route_Details_Setup

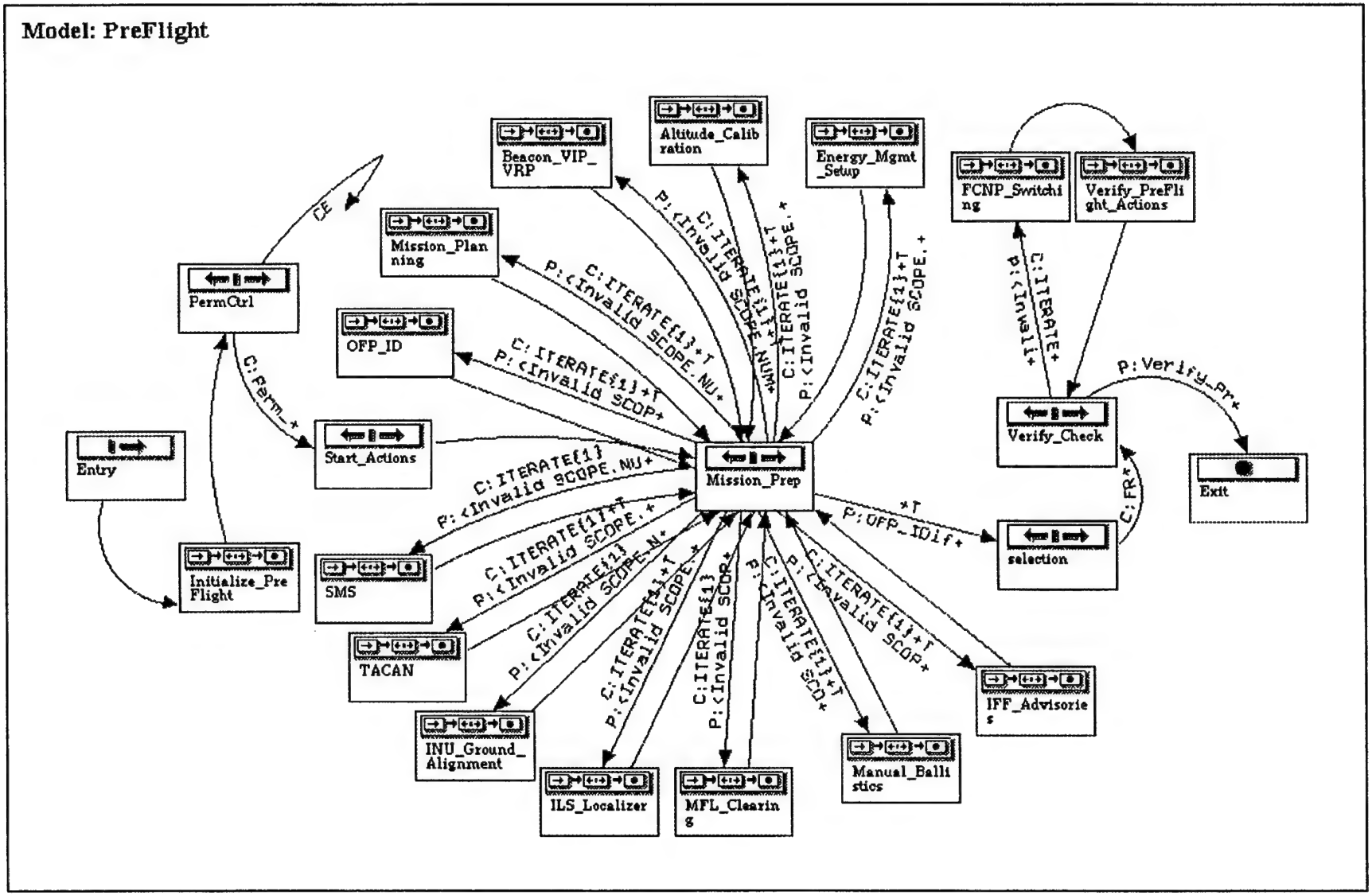

Model: Scenario_1
Entry
Steerpoints_O
AP_Data
UTM_Pengui
n_Data
Flight_Data
TakeOff_Data
Exit
A:Select_UTM+
A:Airspeed=500,Alti*
A:Verify_PreF+

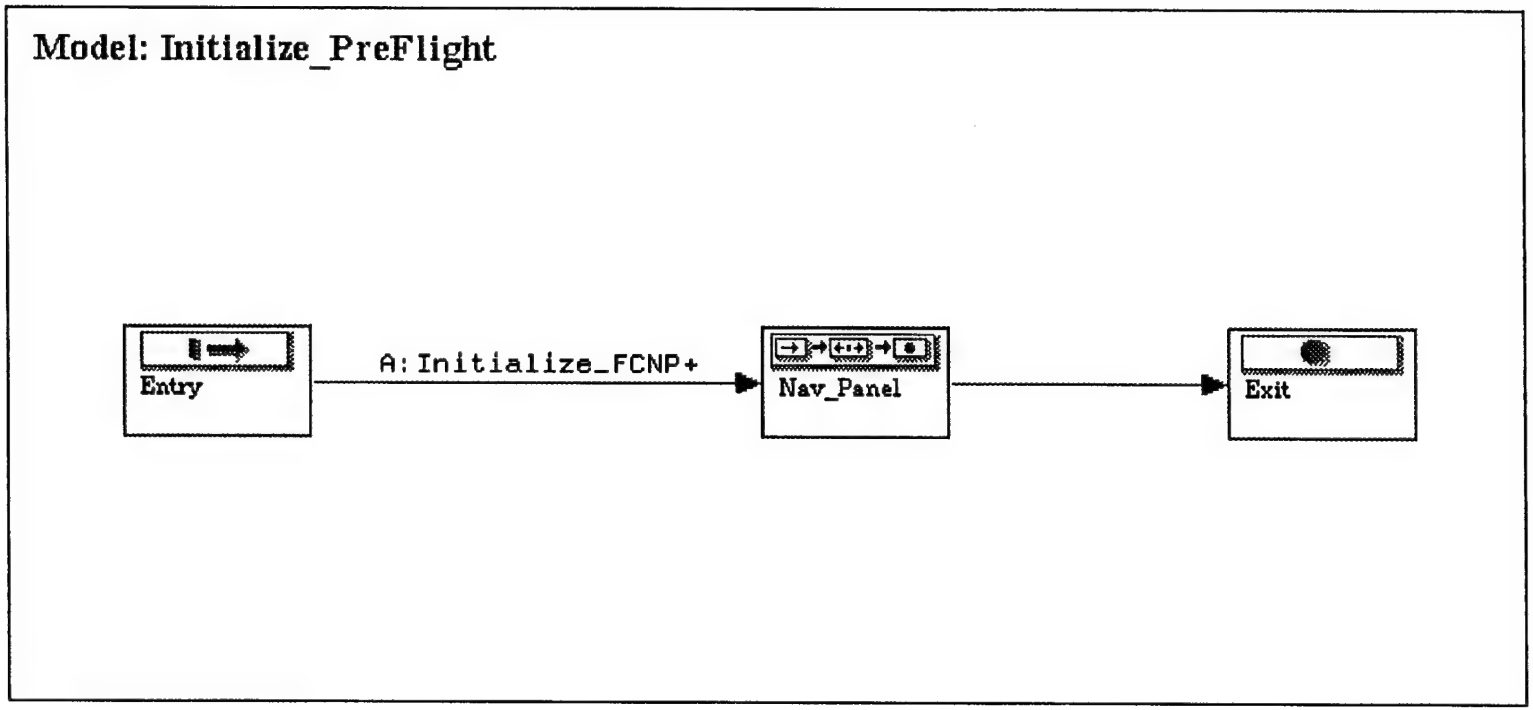
Model: Scenario_2
Entry
Exit
UTM_Pengui n_Data
Alt_Calibratio n_Data
BCN_VIP_VR P_Data
TACAN_Data
OFP_ID_Actio n
Flight_Data
Steerpoint_OA P_Data
Energy_Mgmt _Data
IFF_Advisory _Data
ILS_Data
Man_Ballistic s_Data
TakeOff_Data
A:Select_UTM_Co+
A:Setup_Energy_Mg+
A:Setup_IFF_Advis+
A:Setup_ILS_Local+
A:Airspeed=600,Al+

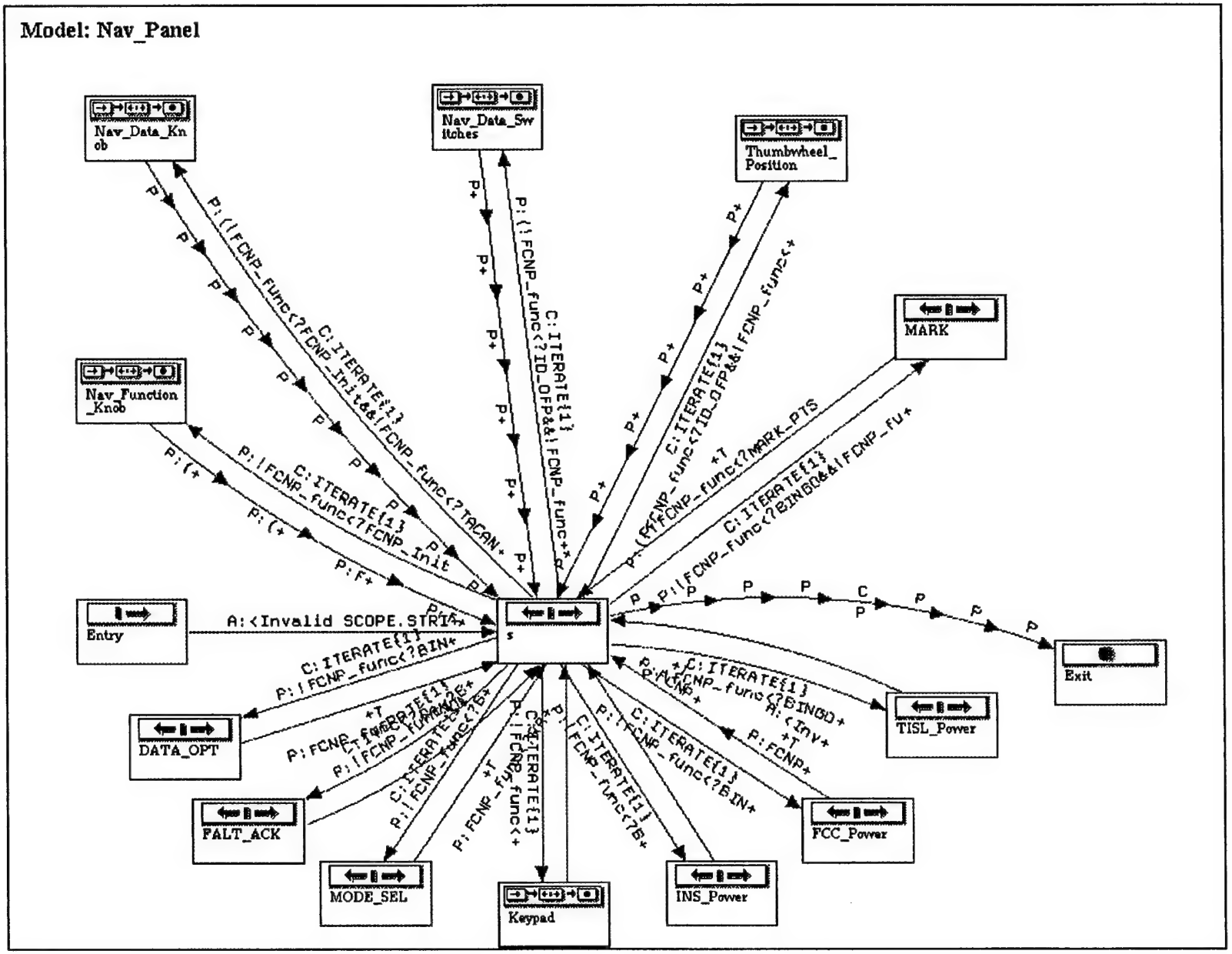

Model: Scenario_3
Entry
Exit
Alt_Calibration_Data
Energy_Mgmt_Data
BCN_VIP_VRP_Data
IFF_Advisory_Data
TACAN_Data
ILS_Data
OFP_ID_Action
Man_Ballistic_Data
Flight_Data
TakeOff_Data
A:Calibrate_Alti+

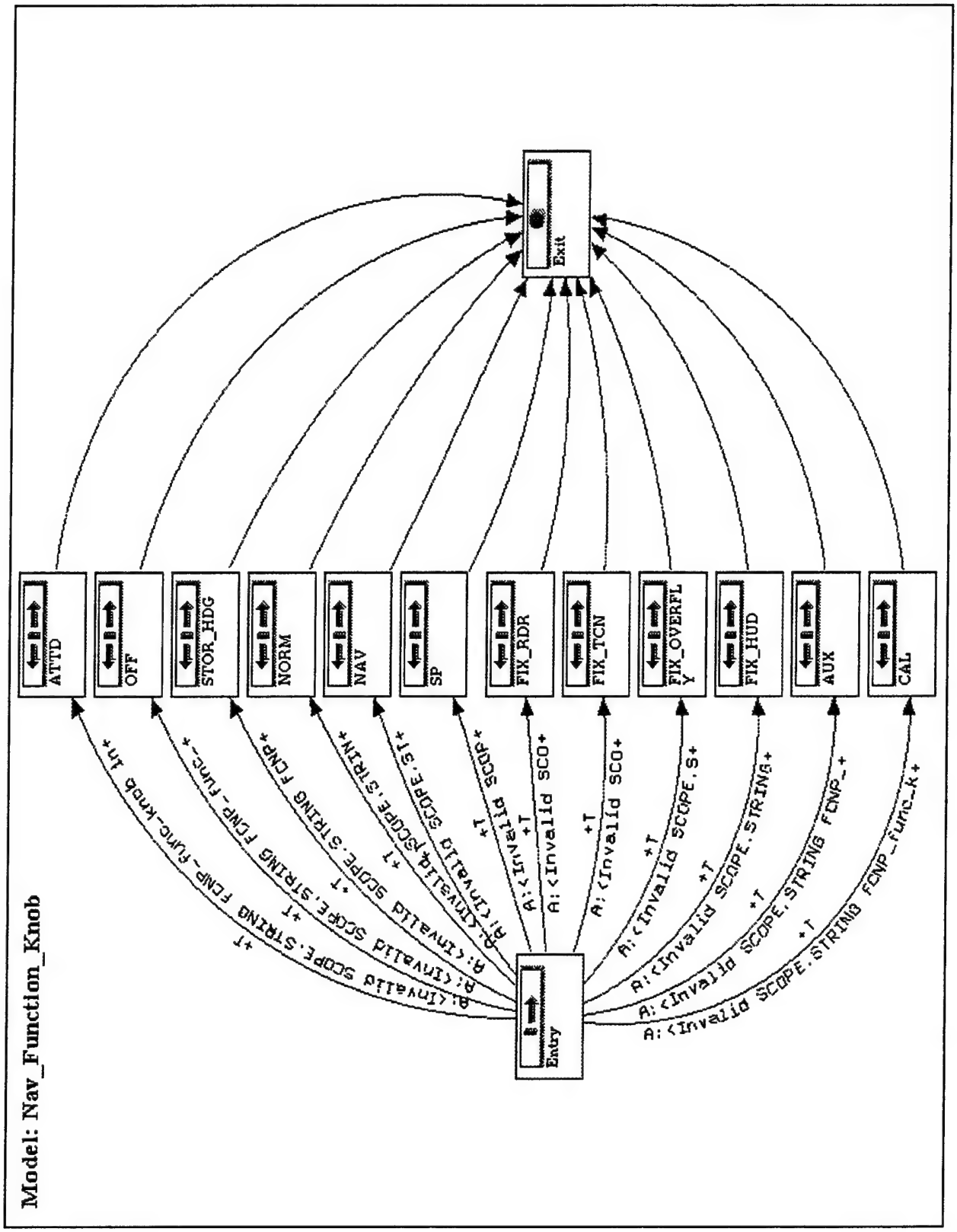

Model: Scenario_4
Entry
+T
A:Air+
TakeOff_Data
A:Ver+
Flight_Data
Exit

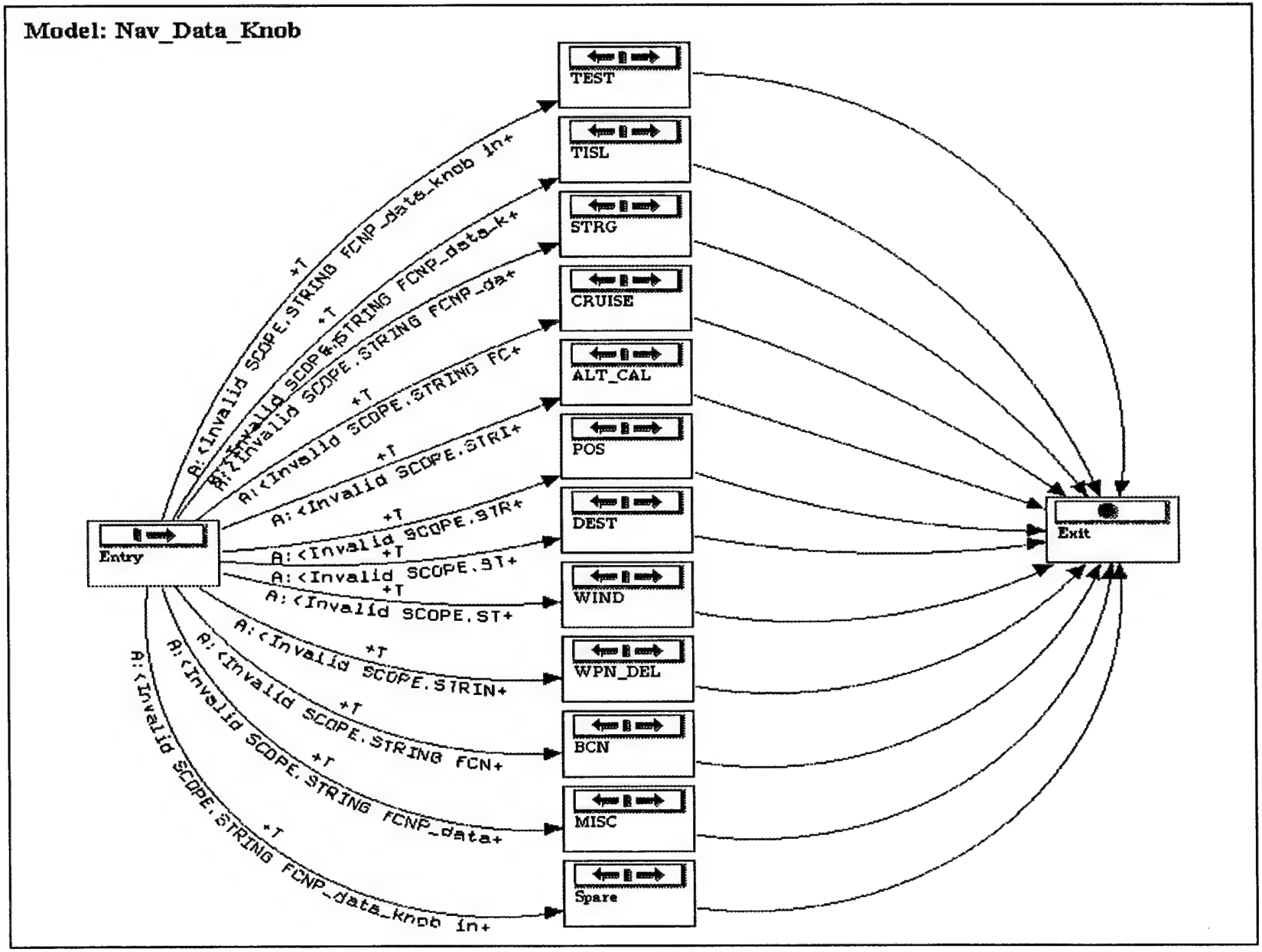

Model: VTS_Setup
Entry
+T
Exit

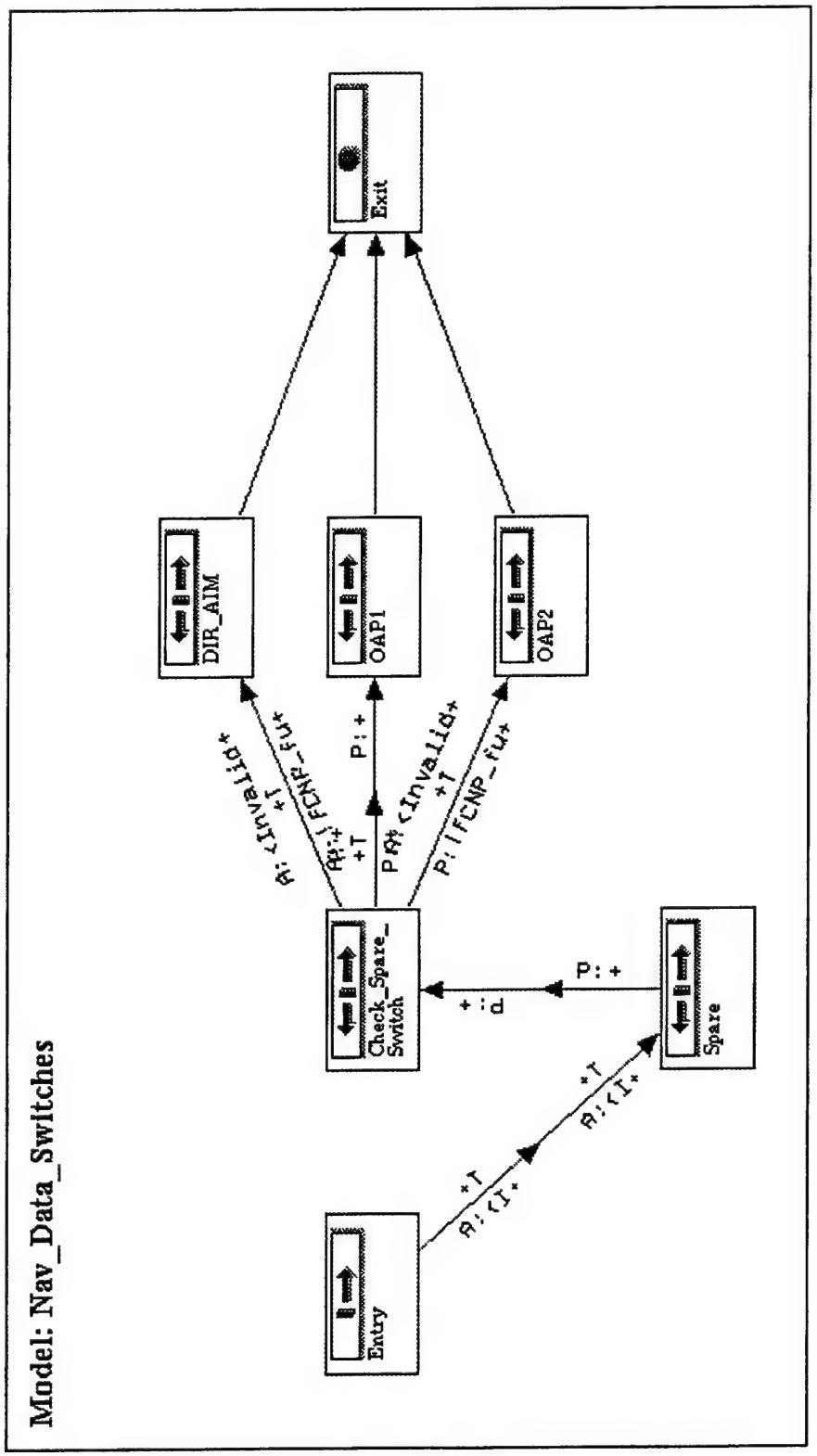

Model: PreFlight
Beacon_VIP_VRP
Altitude_Calibration
Energy_Mgmt_Setup
FCNP_Switching
Verify_PreFlight_Actions
Mission_Planning
PermCtrl
OFP_ID
Entry
Start_Actions
Mission_Prep
Verify_Check
Exit
selection
Initialize_PreFlight
SMS
TACAN
INU_Ground_Alignment
ILS_Localizer
MFL_Clearing
Manual_Ballistics
IFF_Advisories
CE
C:Parm_+
P:Verify_Pr+
C:FR+
P:OFP_IDif+
*T

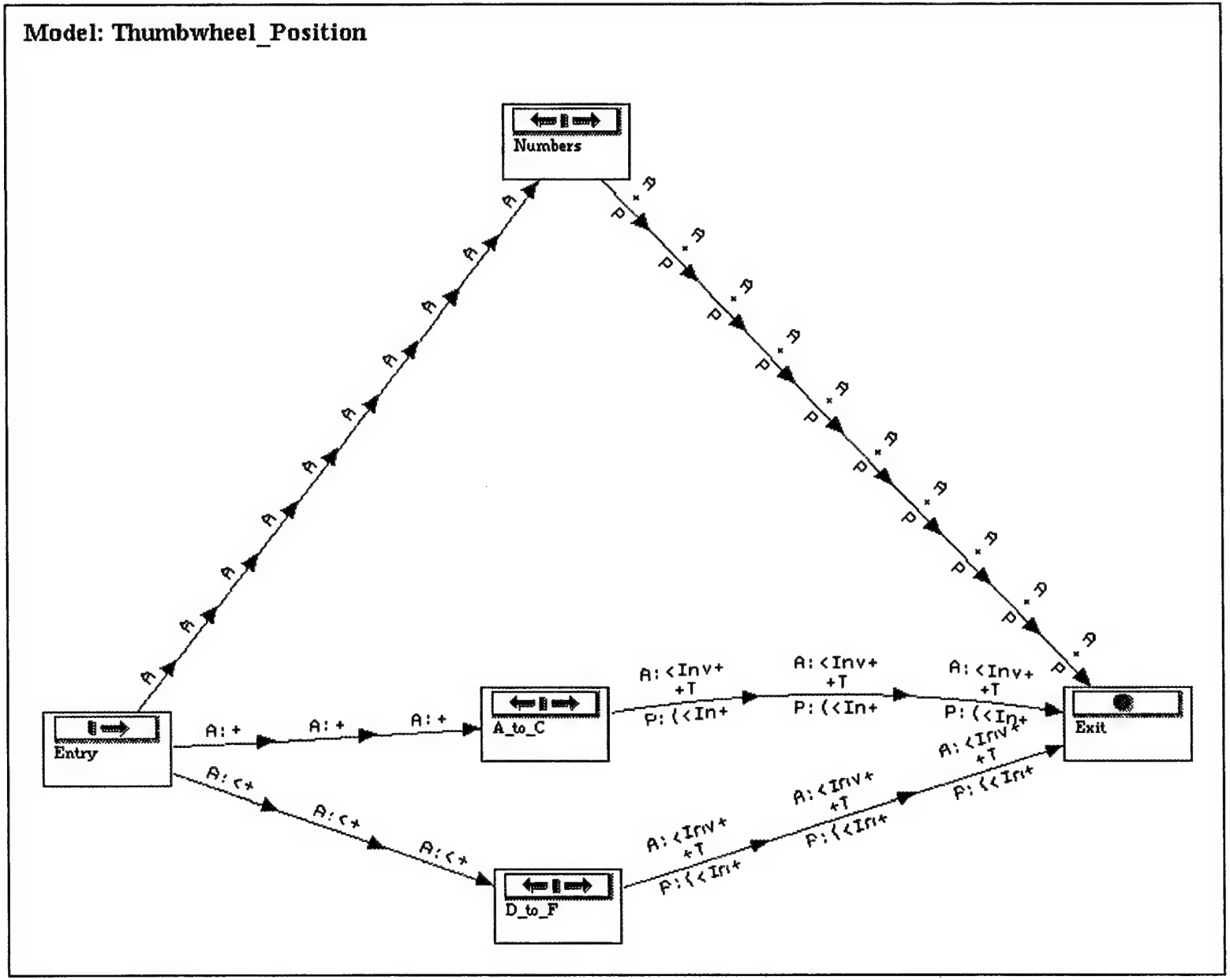

Model: Initialize_PreFlight
Entry
A: Initialize_FCNP+
Nav_Panel
Exit

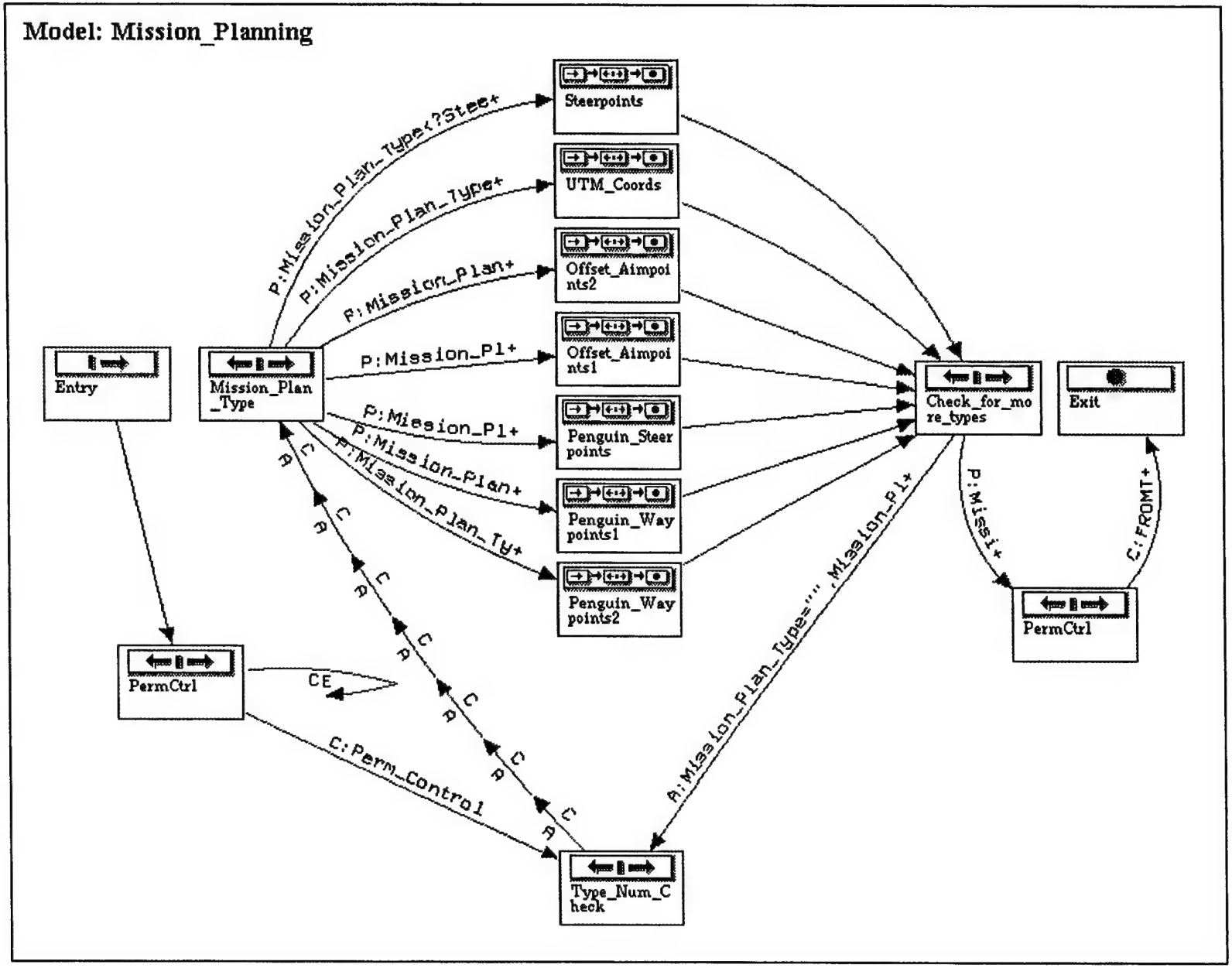

Model: Nav_Panel
Nav_Data_Knob
Nav_Data_Switches
Thumbwheel_Position
MARK
Nav_Function_Knob
Entry
s
Exit
DATA_OPT
FALT_ACK
MODE_SEL
Keypad
INS_Power
FCC_Power
TISL_Power
A:<Invalid SCOPE.STRI
C:ITERATE{1}
P:!FCNP_func<?BIN
P:!FCNP_func<?TACAN
P:!FCNP_func<?FCNP_Init
P:!FCNP_func<?ID_OFP&&!FCNP_func
P:!FCNP_func<?MARK_PTS
P:!FCNP_func<?BINOD
P:!FCNP_func<?B
P:!FCNP_func<?FCNP_Init&&!FCNP_func
P:!FCNP_func<?ID_OFP&&!FCNP_func
P:!FCNP_func<?BINOD&&!FCNP_fu
P:!FCNP_func<?B
P:FCNP_func<
P:FCNP+
A:<inv+
P+
P
C
+T

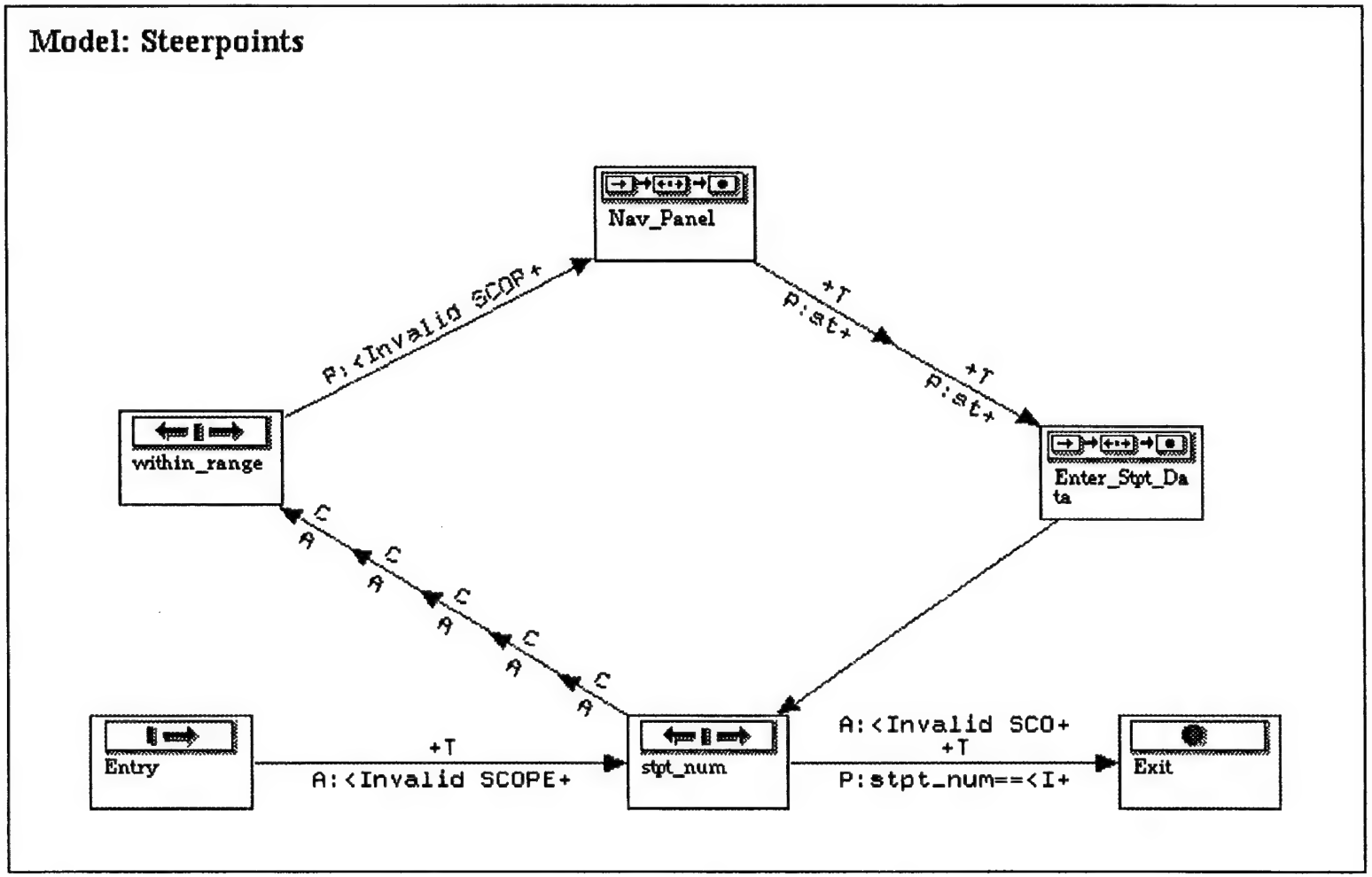

Model: Nav_Function_Knob
Entry
Exit
ATTD
OFF
STOR_HDG
NORM
NAV
SP
FIX_RDR
FIX_TCN
FIX_OVERFLY
FIX_HUD
AUX
CAL
A:<Invalid SCOPE.STRING FCNP_Func_K+ +T
A:<Invalid SCOPE.STRING FCNP_+ +T
A:<Invalid SCOPE.STRING+ +T
A:<Invalid SCOPE.S+ +T
A:<Invalid SCO+ +T
A:<Invalid SCO+ +T
A:<Invalid SCOPE.ST+ +T
A:<Invalid SCOPE.STRING FCNP+ +T
A:<Invalid SCOPE.STRING FCNP_Func_+ +T
A:<Invalid SCOPE.STRING FCNP_Func_Knob In+ +T

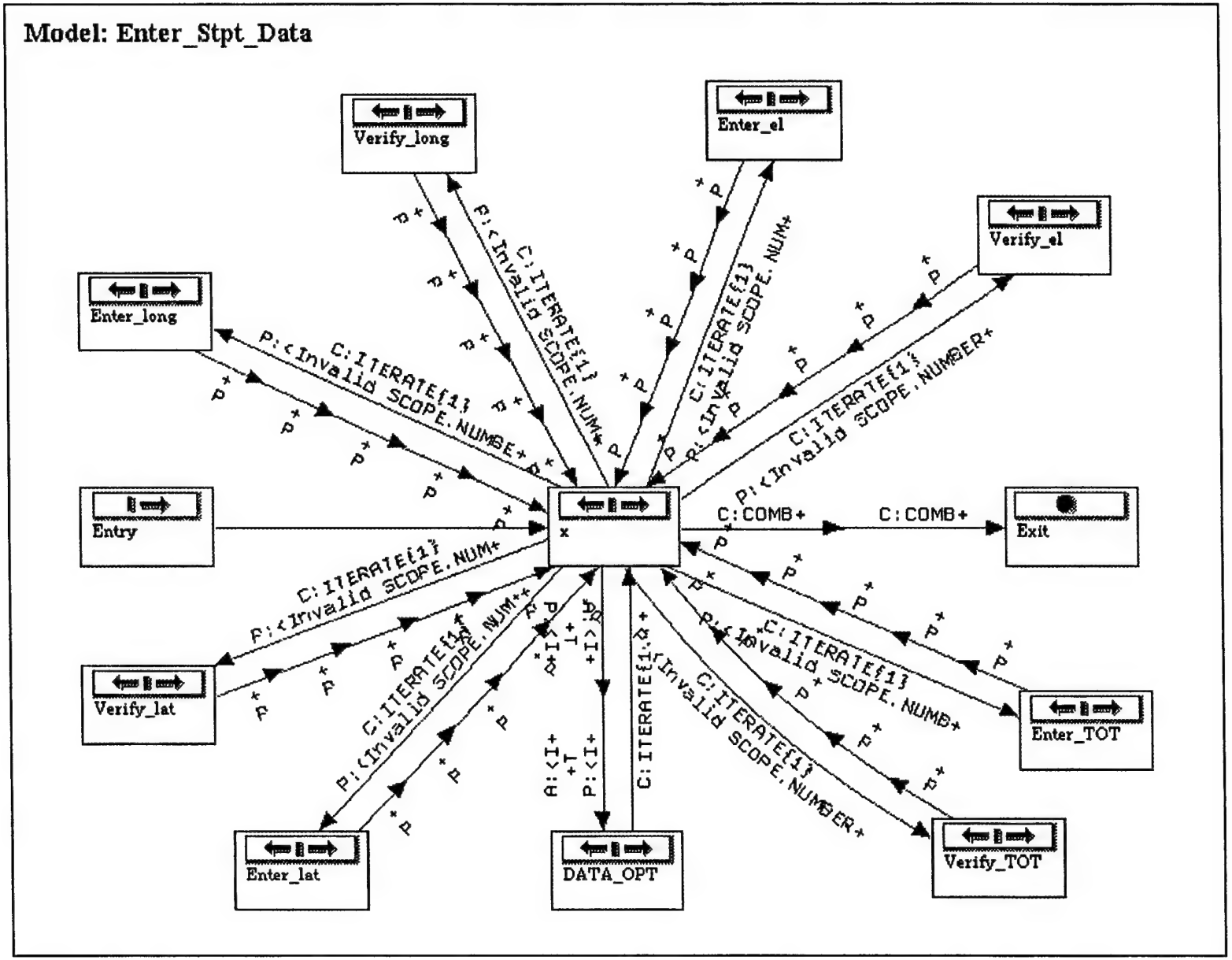

Model: Nav_Data_Knob
Entry
TEST
TISL
STRG
CRUISE
ALT_CAL
POS
DEST
WIND
WPN_DEL
BCN
MISC
Spare
Exit
A:<Invalid SCOPE.STRING FCNP_data_knob in+
A:<Invalid SCOPE.STRING FCNP_data_k+
A:<Invalid SCOPE.STRING FCNP_da+
A:<Invalid SCOPE.STRING FC+
A:<Invalid SCOPE.STRI+
A:<Invalid SCOPE.STR+
A:<Invalid SCOPE.ST+
A:<Invalid SCOPE.ST+
A:<Invalid SCOPE.STRIN+
A:<Invalid SCOPE.STRING FCN+
A:<Invalid SCOPE.STRING FCNP_data+
A:<Invalid SCOPE.STRING FCNP_data_knob in+
*T

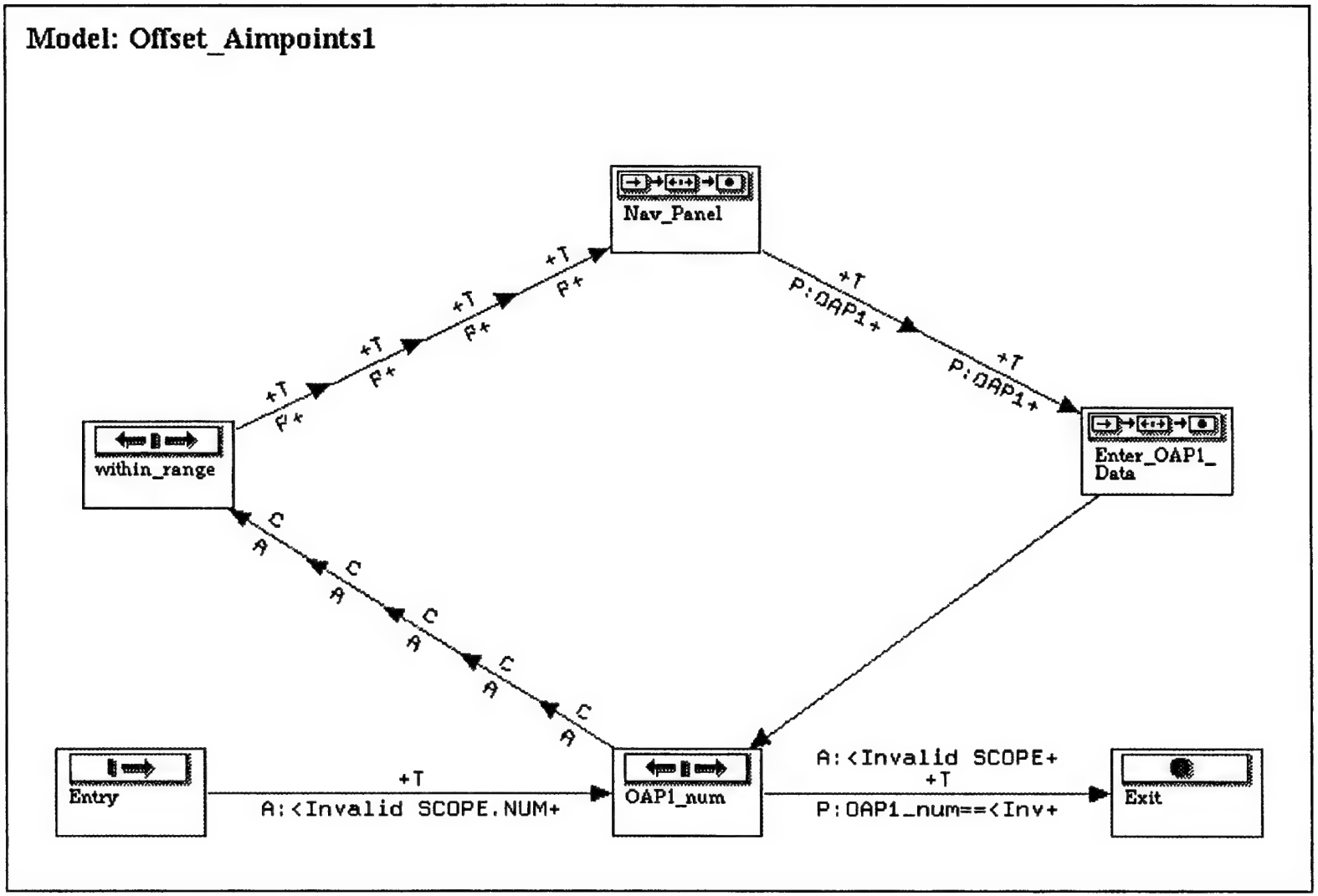

Model: Nav_Data_Switches
Entry
Check_Spare_Switch
Spare
DIR_AIM
OAP1
OAP2
Exit
P: +
+T
P: +
+T
P: +
+T
P: +
+T

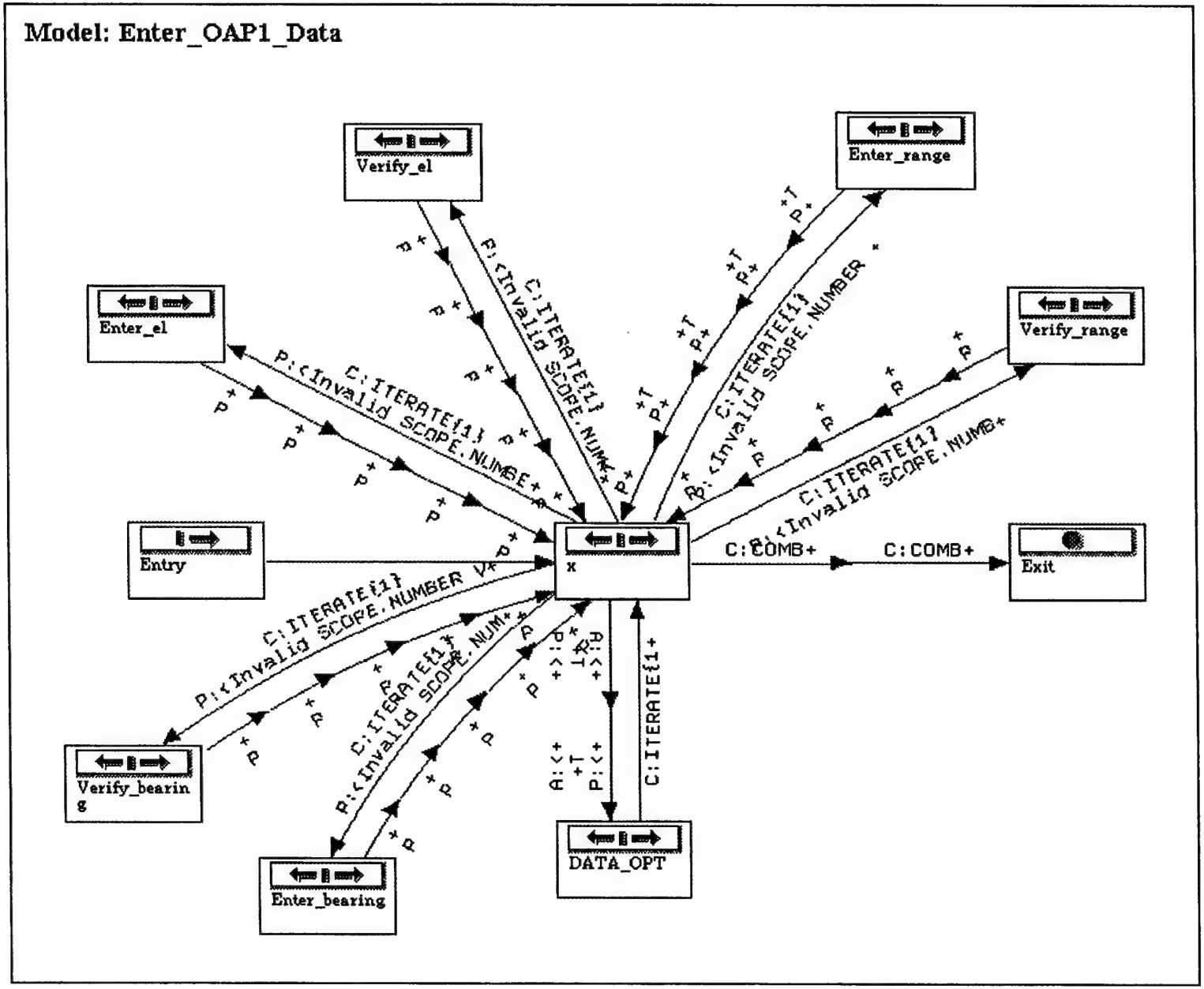

Model: Thumbwheel_Position
Numbers
Entry
A_to_C
D_to_F
Exit
A: +
A: <
A: <Inv+ +T
P: (<In+

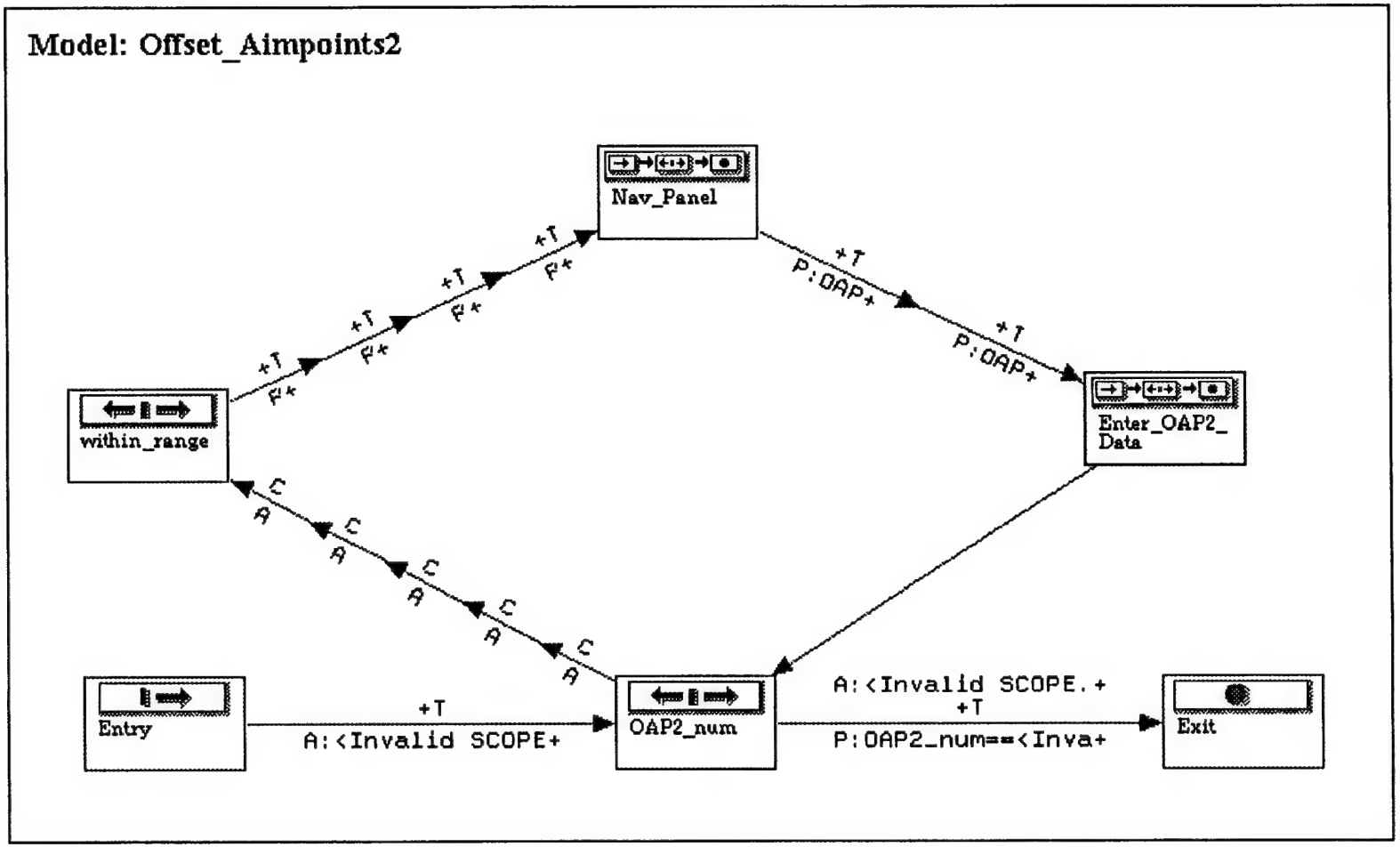

Model: Mission_Planning
Steerpoints
UTM_Coords
Offset_Aimpoints2
Offset_Aimpoints1
Penguin_Steerpoints
Penguin_Waypoints1
Penguin_Waypoints2
Entry
Mission_Plan_Type
Check_for_more_types
Exit
PermCtrl
PermCtrl
Type_Num_Check
P:Mission_Plan_Type<?Stee+
P:Mission_Plan_Type+
P:Mission_Plan+
P:Mission_Pl+
P:Mission_Pl+
P:Mission_Plan+
P:Mission_Plan_Ty+
A
C
CE
C:Perm_Control
A:Mission_Plan_Type="",Mission_Pl+
P:Missi+
C:FROMT+

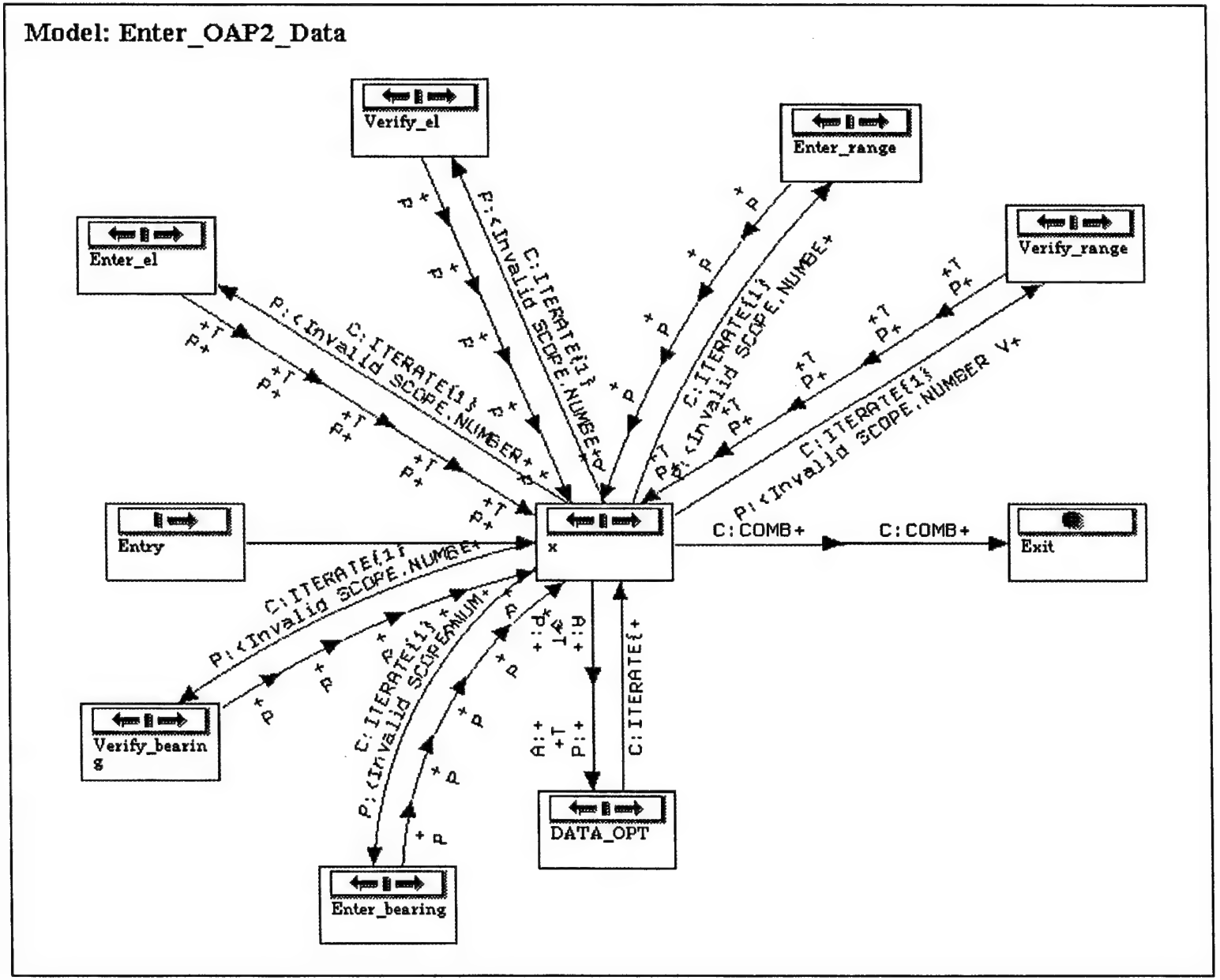

Model: Steerpoints
Nav_Panel
P:<Invalid SCOP+
+T
P:st+
+T
P:st+
within_range
Enter_Stpt_Da
ta
C
A
C
A
C
A
C
A
C
A
Entry
+T
A:<Invalid SCOPE+
stpt_num
A:<Invalid SCO+
+T
P:stpt_num==<I+
Exit

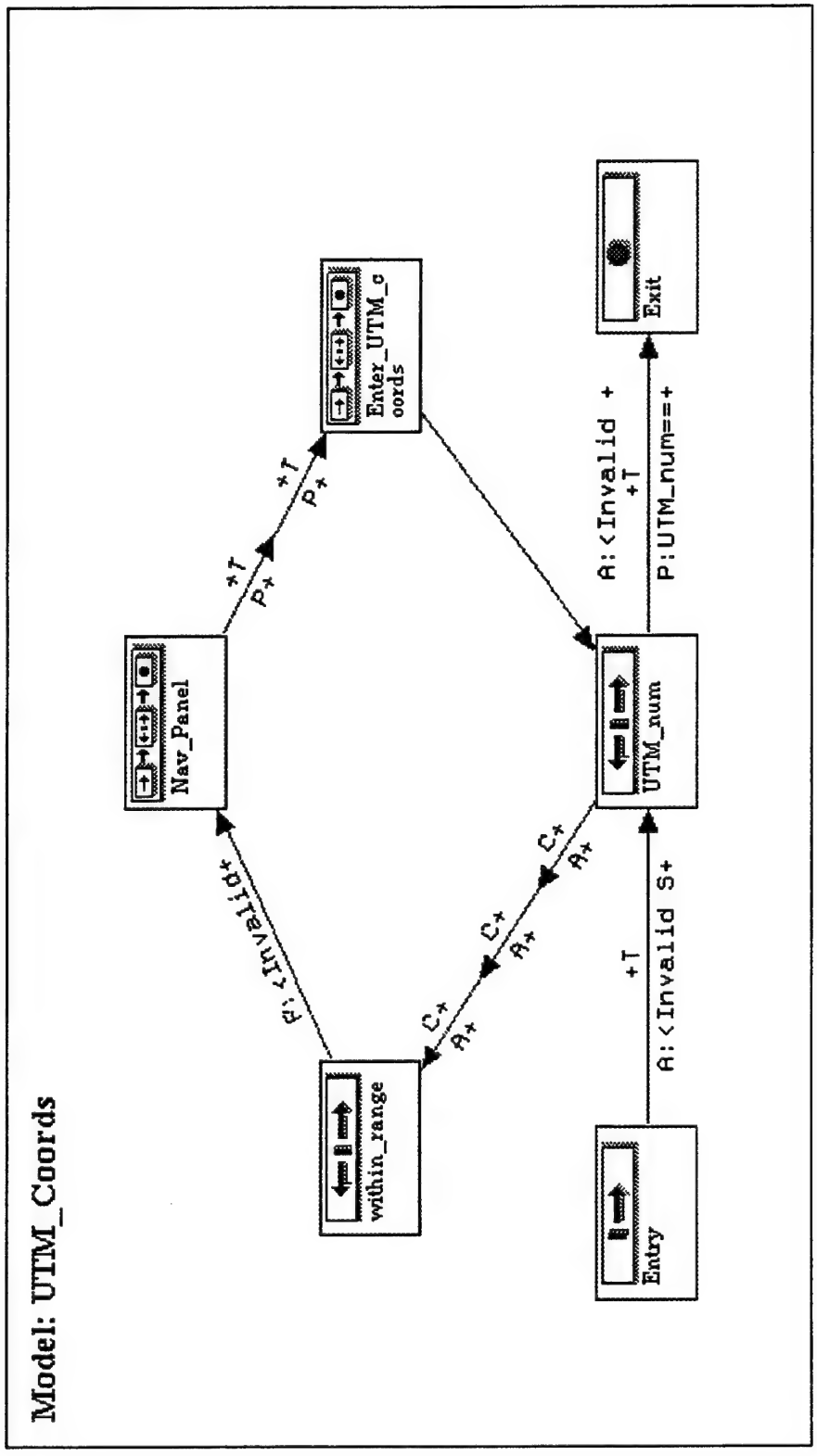

Model: Enter_Stpt_Data
Verify_long
Enter_el
Verify_el
Enter_long
Entry
Exit
Verify_lat
Enter_TOT
Enter_lat
DATA_OPT
Verify_TOT
C:COMB+
C:COMB+


Model: Offset_Aimpoints1
Nav_Panel
within_range
Enter_OAP1_
Data
Entry
OAP1_num
Exit
+T
P*
P:OAP1+
C
A
A:<Invalid SCOPE.NUM+
A:<Invalid SCOPE+
P:OAP1_num==<Inv+

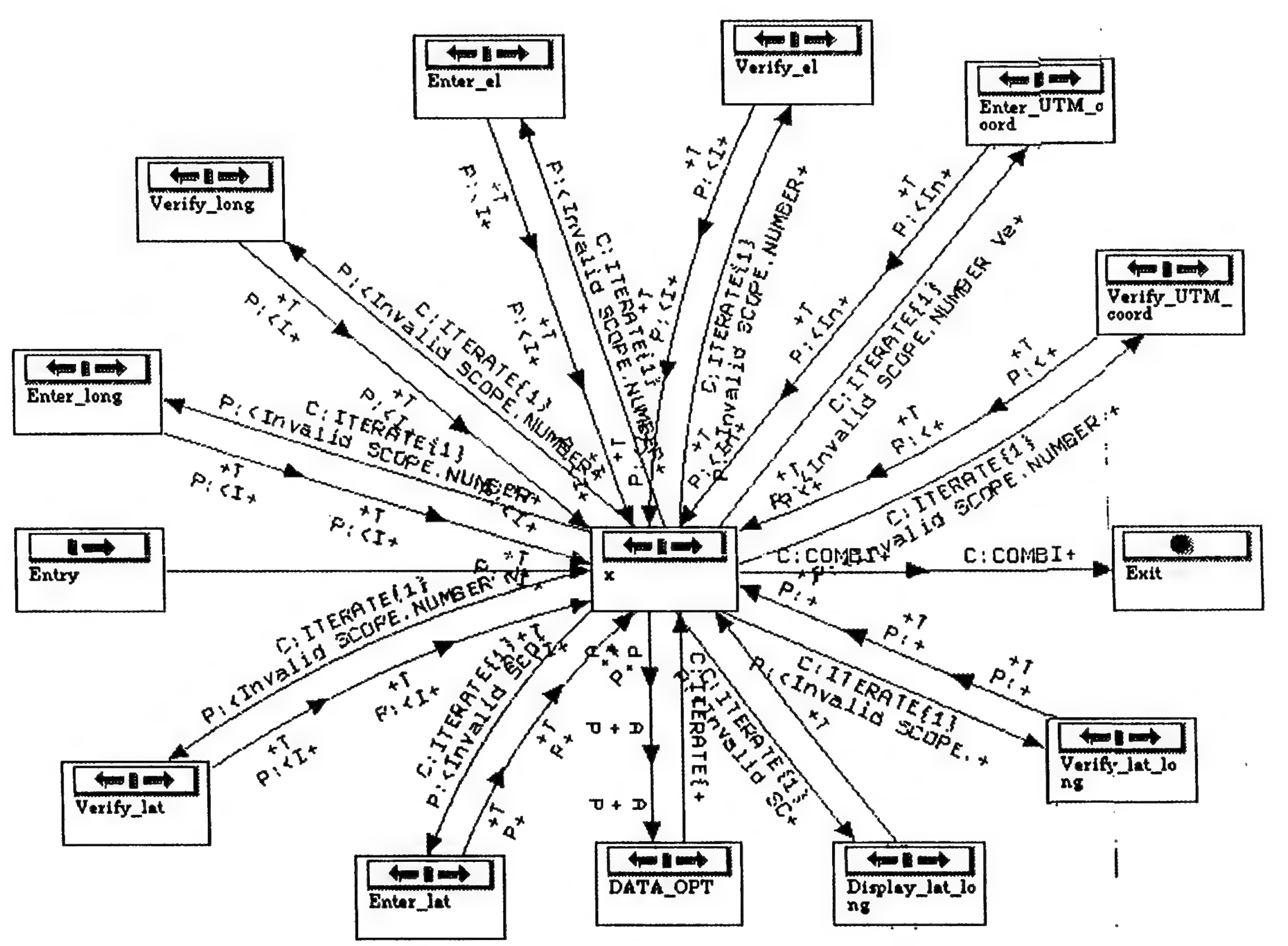

Model: Enter_OAP1_Data
Verify_el
Enter_range
Enter_el
Verify_range
Entry
x
Exit
Verify_bearing
Enter_bearing
DATA_OPT
C:COMB+
C:COMB+
C:ITERATE{1}
C:ITERATE{1+

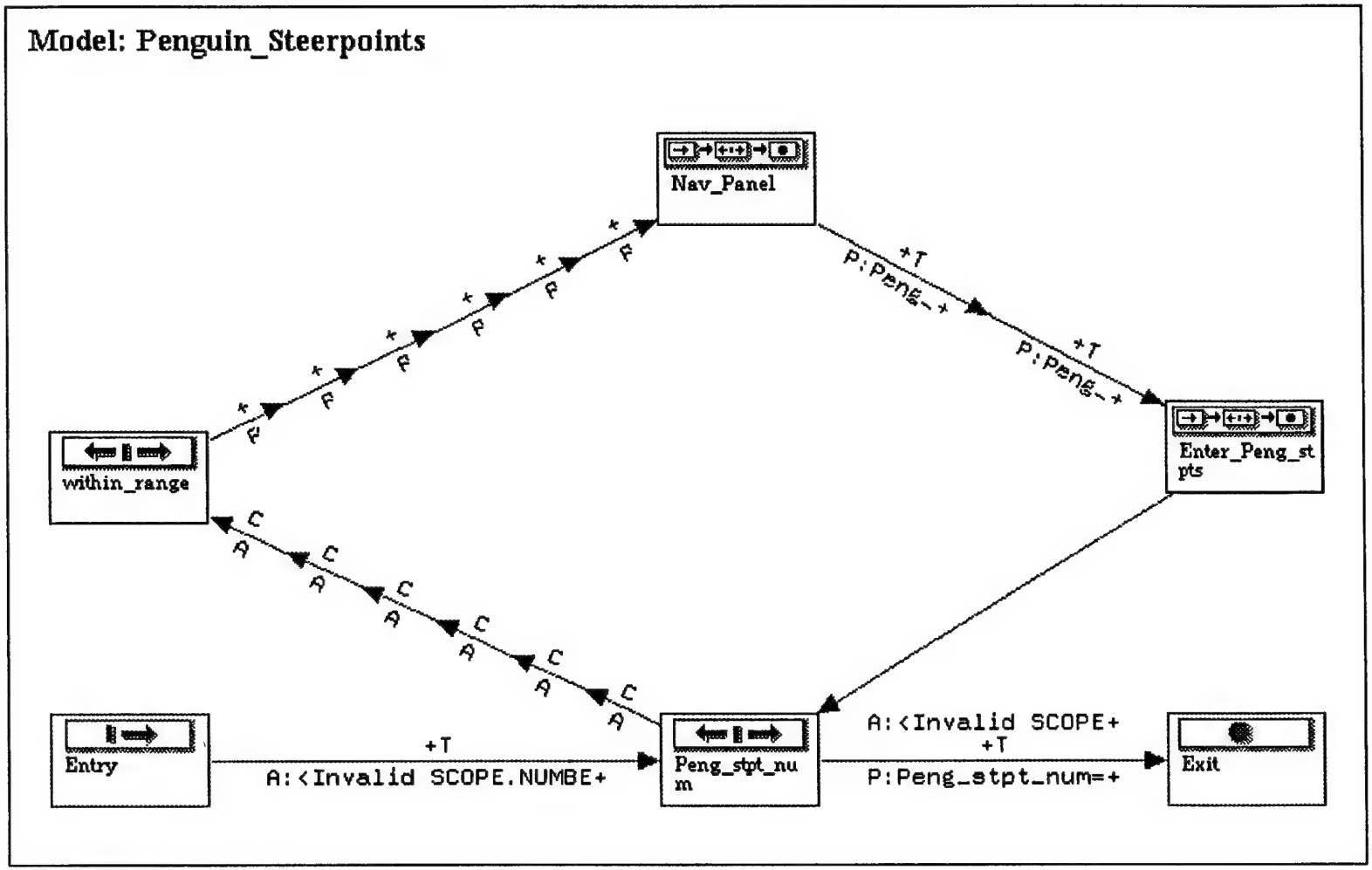

Model: Offset_Aimpoints2
Nav_Panel
within_range
Enter_OAP2_
Data
Entry
OAP2_num
Exit
+T
P:OAP+
+T
P:OAP+
+T
P*
+T
P*
+T
P*
+T
P*
C
A
C
A
C
A
C
A
+T
A:<Invalid SCOPE+
A:<Invalid SCOPE.+
+T
P:OAP2_num==<Inva+


Model: Enter_OAP2_Data
Verify_el
Enter_range
Enter_el
Verify_range
Entry
x
Exit
Verify_bearin
g
DATA_OPT
Enter_bearing
C:COMB+
C:COMB+

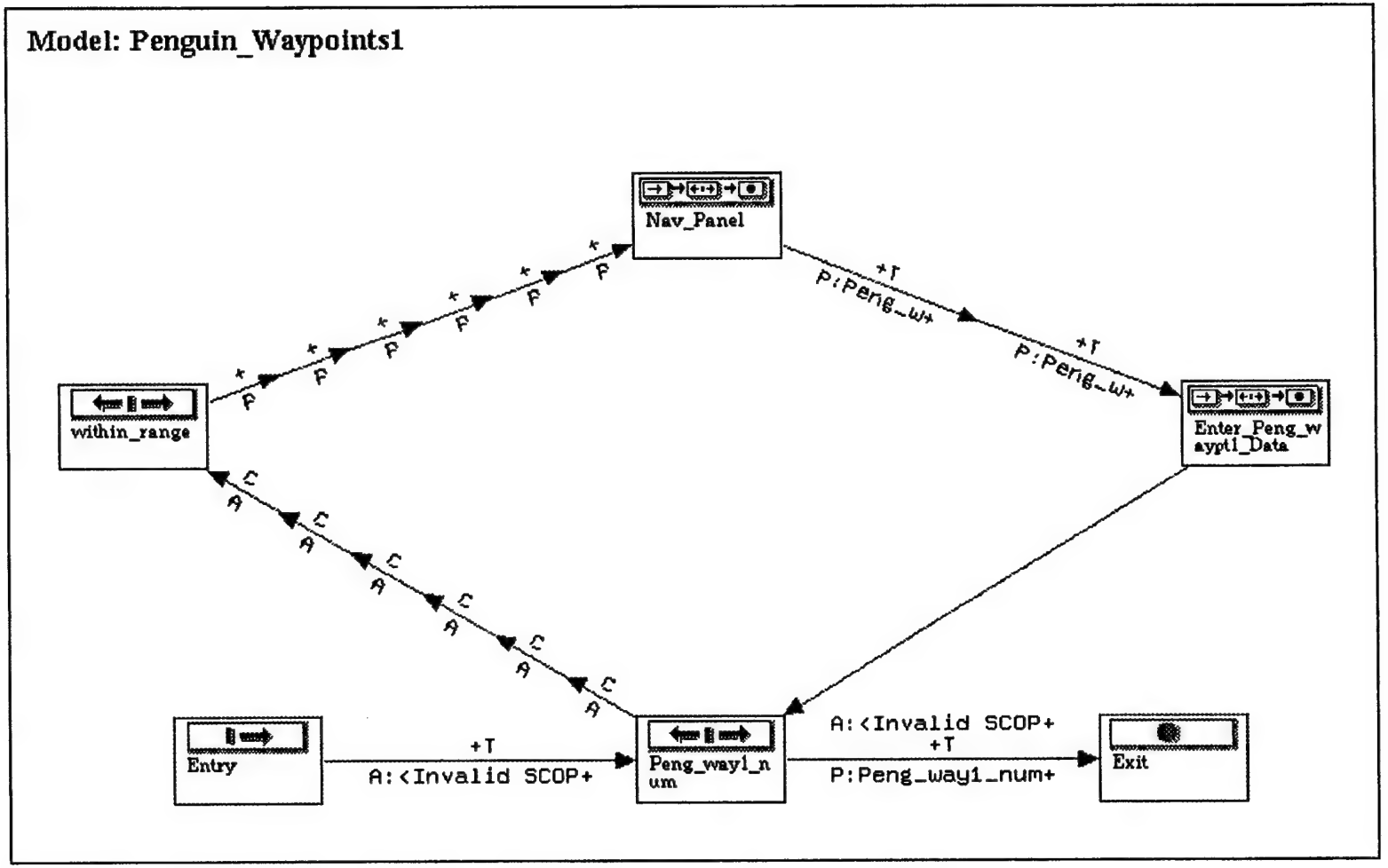

Model: UTM_Coords
Nav_Panel
Enter_UTM_c
oords
Exit
UTM_num
within_range
Entry
*T
P+
P:<Invalid+
C+
A+
+T
A:<Invalid S+
A:<Invalid +
+T
P:UTM_num==+

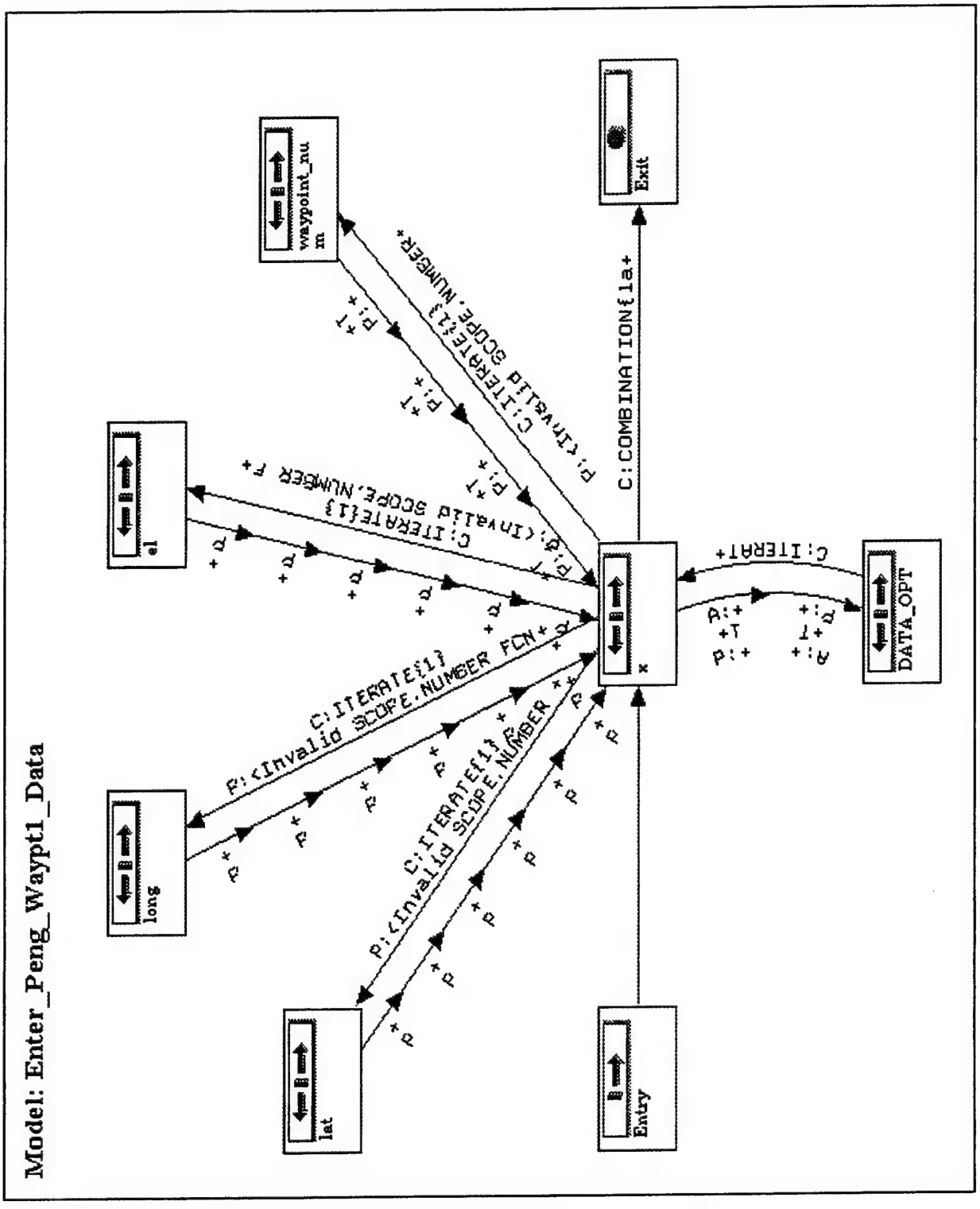
Model: Enter_UTM_Coords

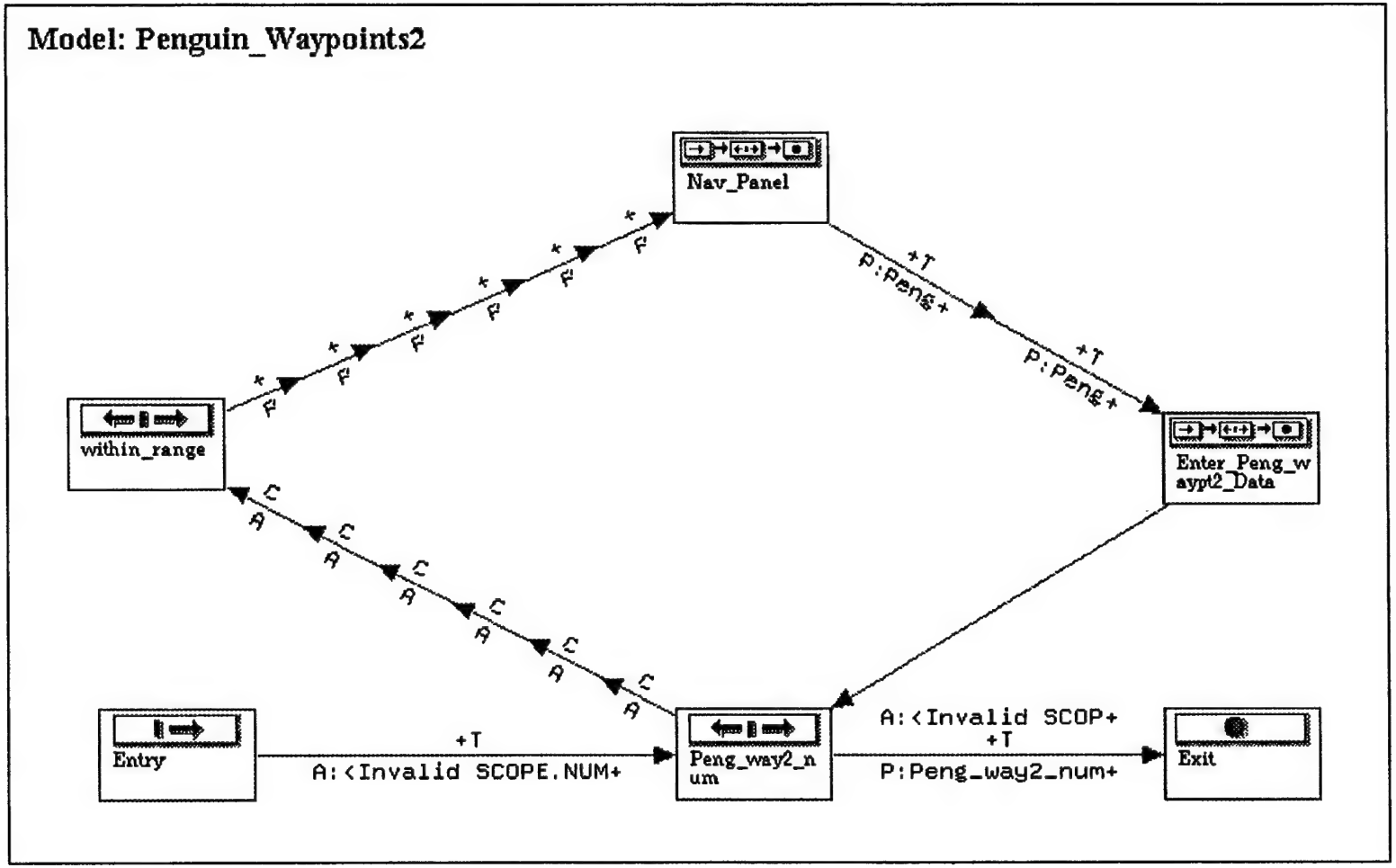


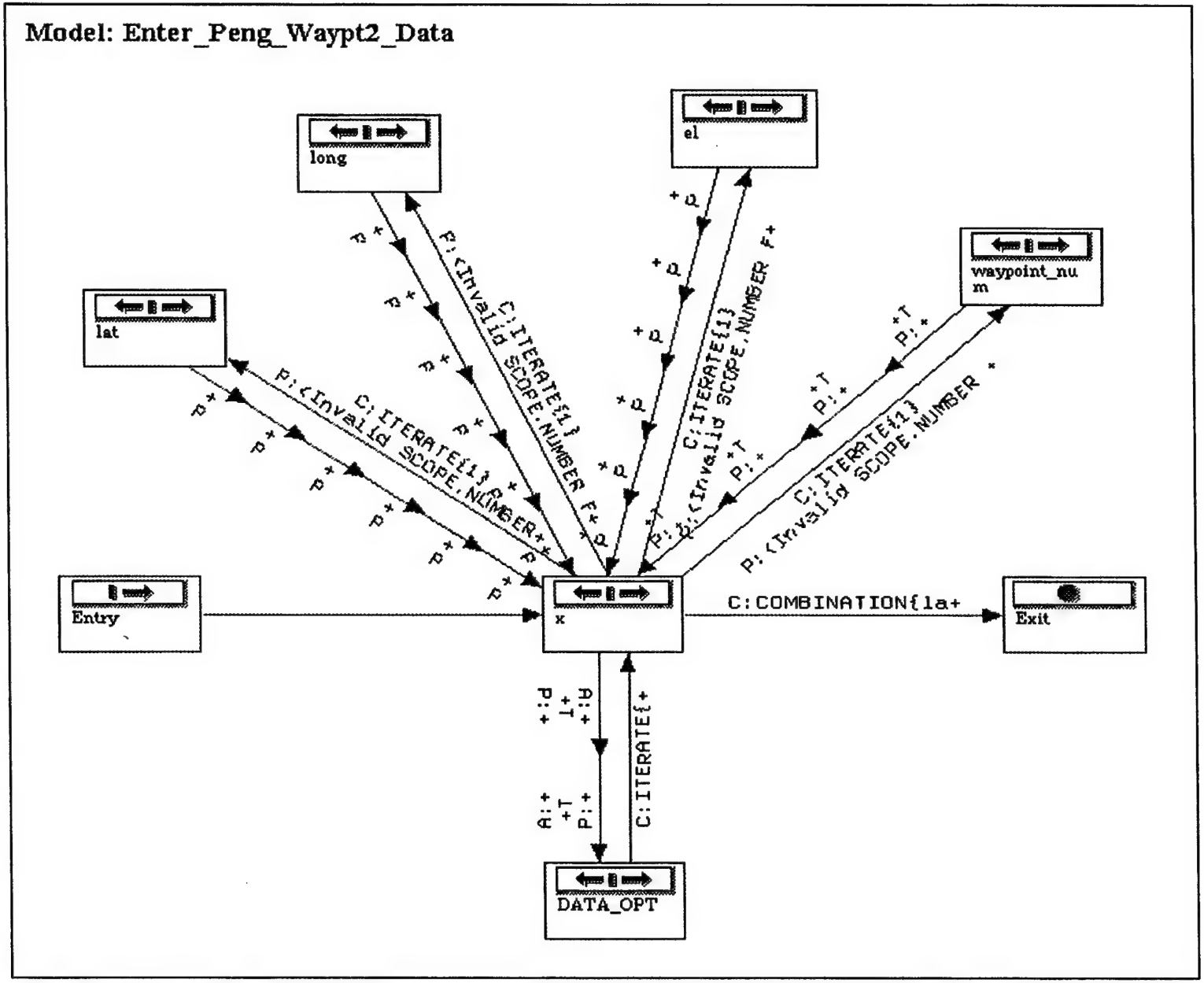

Model: Penguin_Steerpoints
Nav_Panel
+T
P:Peng_+
+T
P:Peng_+
Enter_Peng_st
pts
within_range
Entry
+T
A:<Invalid SCOPE.NUMBE+
Peng_stpt_nu
m
A:<Invalid SCOPE+
+T
P:Peng_stpt_num=+
Exit

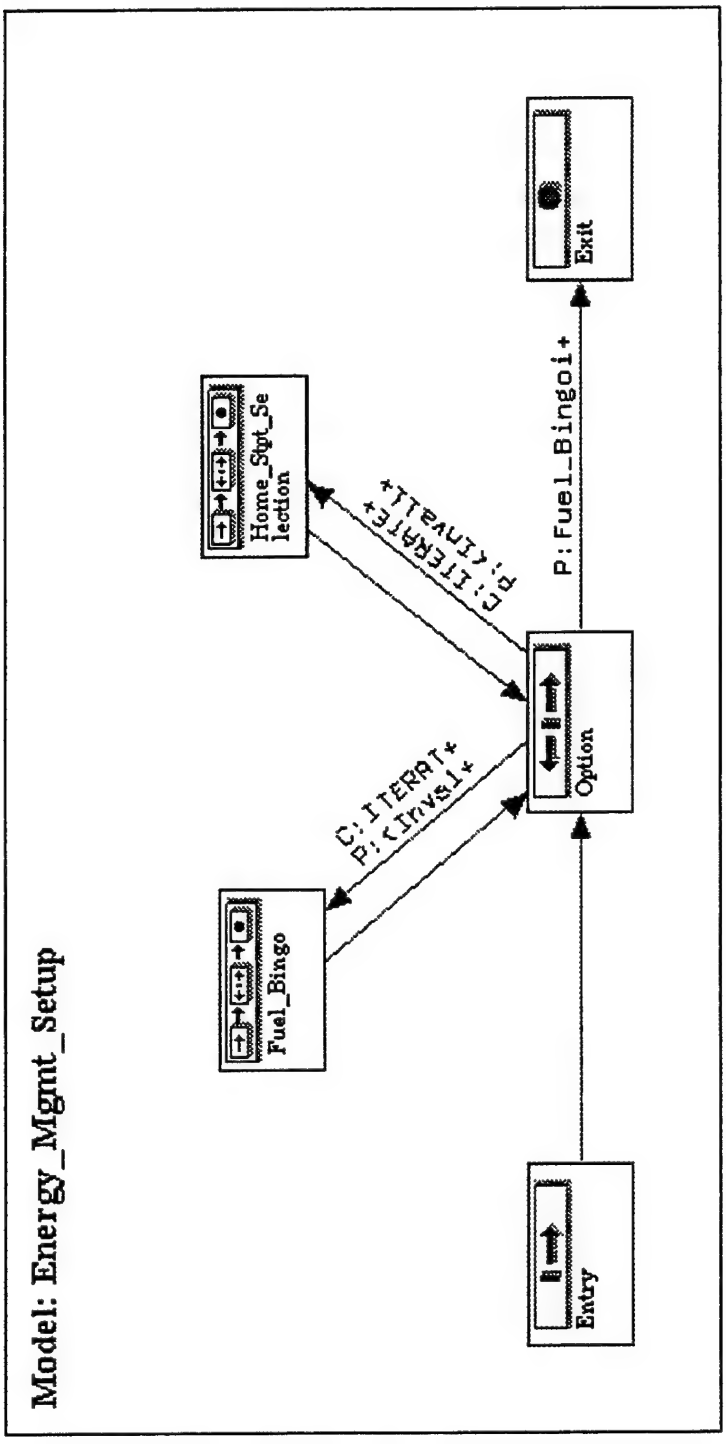
Model: Enter_Peng_Stpts
tgt_trk
Exit
tgt_vel
TOD
TOT
DATA_OPT
el
long
Entry
lat
C:COMBINATION{lat,+
C:ITERATE{1}
P:<Invalid SCOPE.NUMBER+

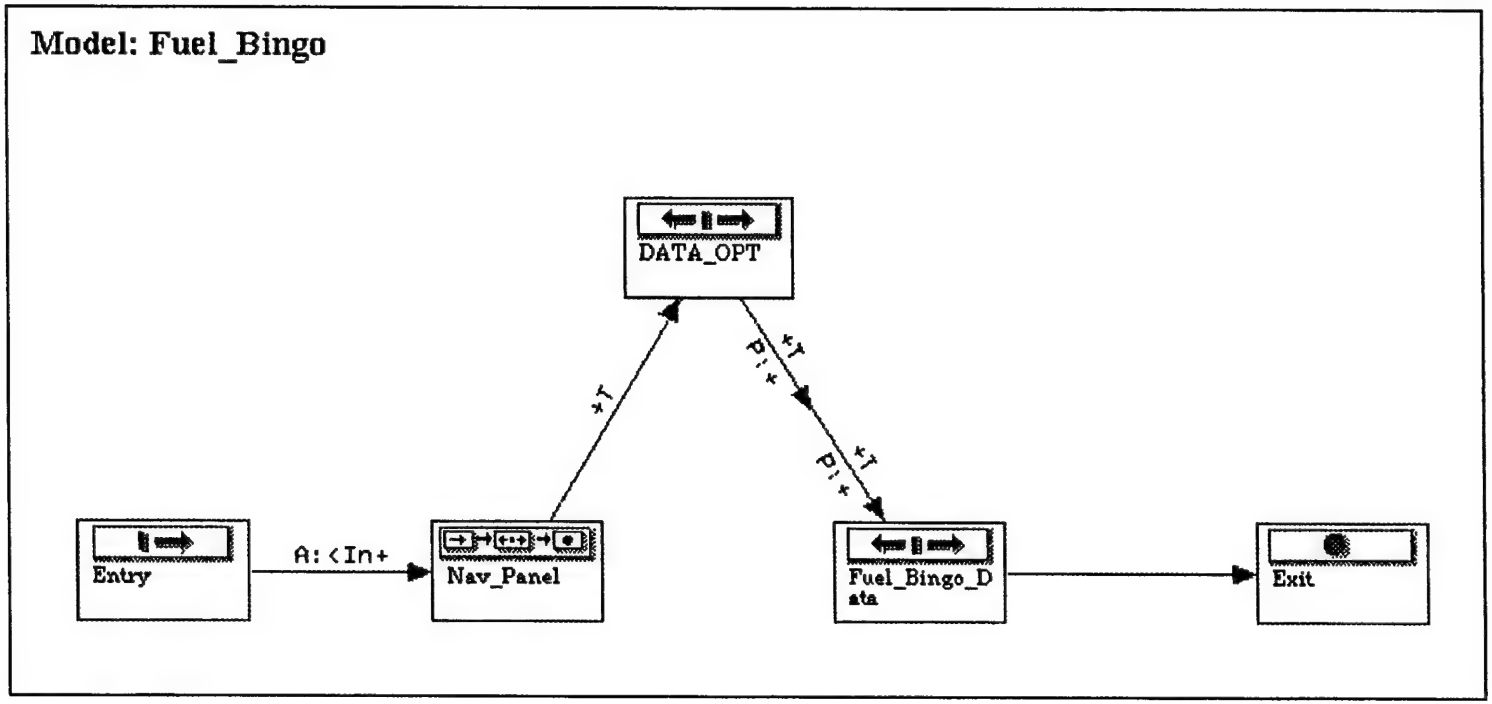

Model: Penguin_Waypoints1
Nav_Panel
within_range
Enter_Peng_waypt1_Data
Entry
Peng_way1_num
Exit
+T
P:Peng_w+
+T
P:Peng_w+
+T
A:<Invalid SCOP+
+T
A:<Invalid SCOP+
+T
P:Peng_way1_num+

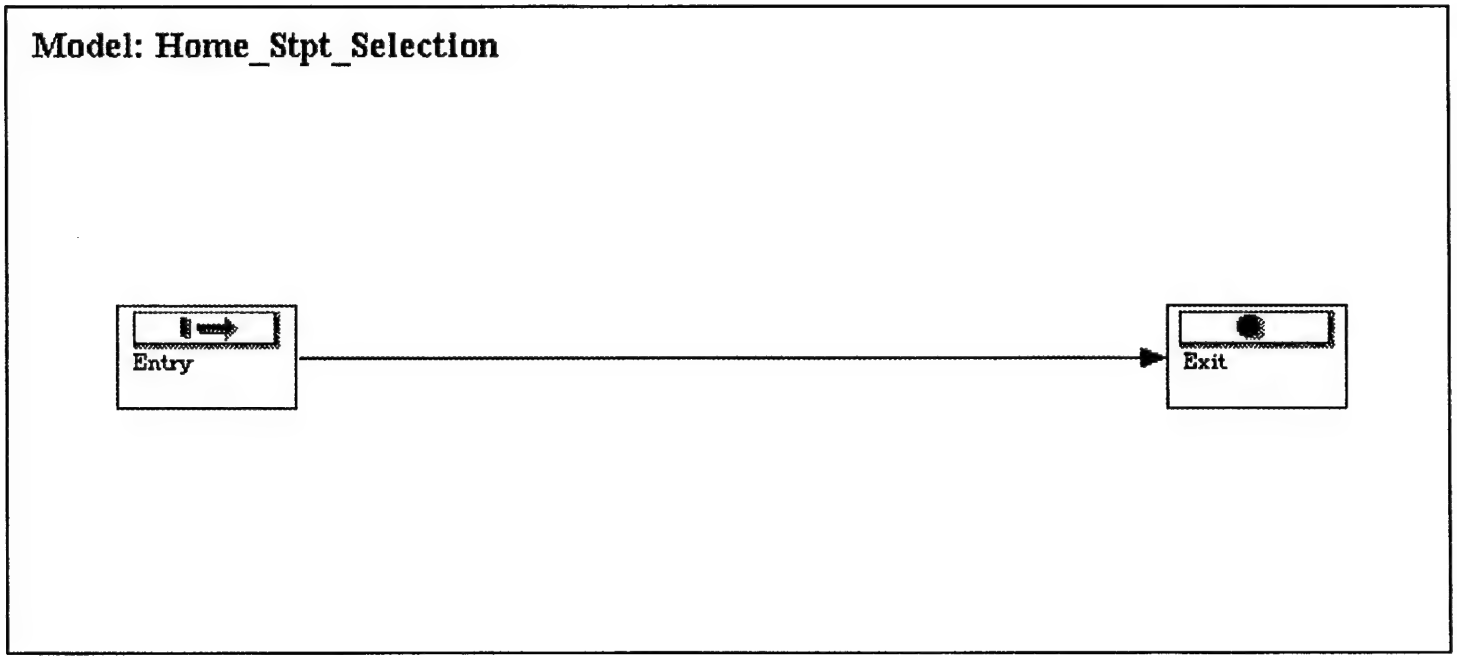

Model: Enter_Peng_Waypt1_Data
waypoint_nu
m
Exit
el
long
lat
Entry
DATA_OPT
C:COMBINATION{1a+
C:ITERATE{1}
P:<Invalid SCOPE.NUMBER FCN+
C:ITERAT+

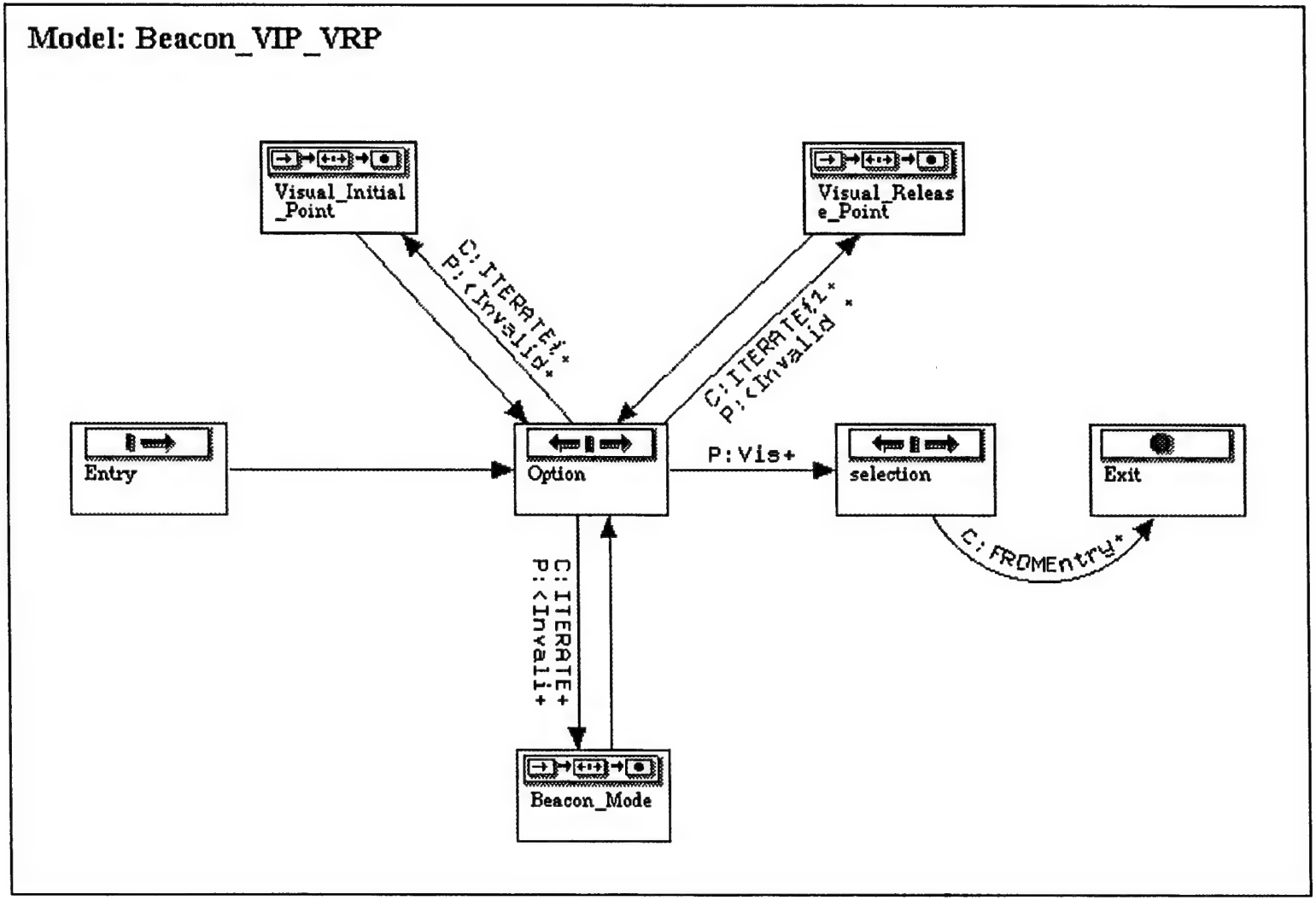

Model: Penguin_Waypoints2
Nav_Panel
within_range
Enter_Peng_waypt2_Data
Entry
Peng_way2_num
Exit
+T
P:Peng+
+T
P:Peng+
+T
A:<Invalid SCOPE.NUM+
A:<Invalid SCOP+
+T
P:Peng_way2_num+

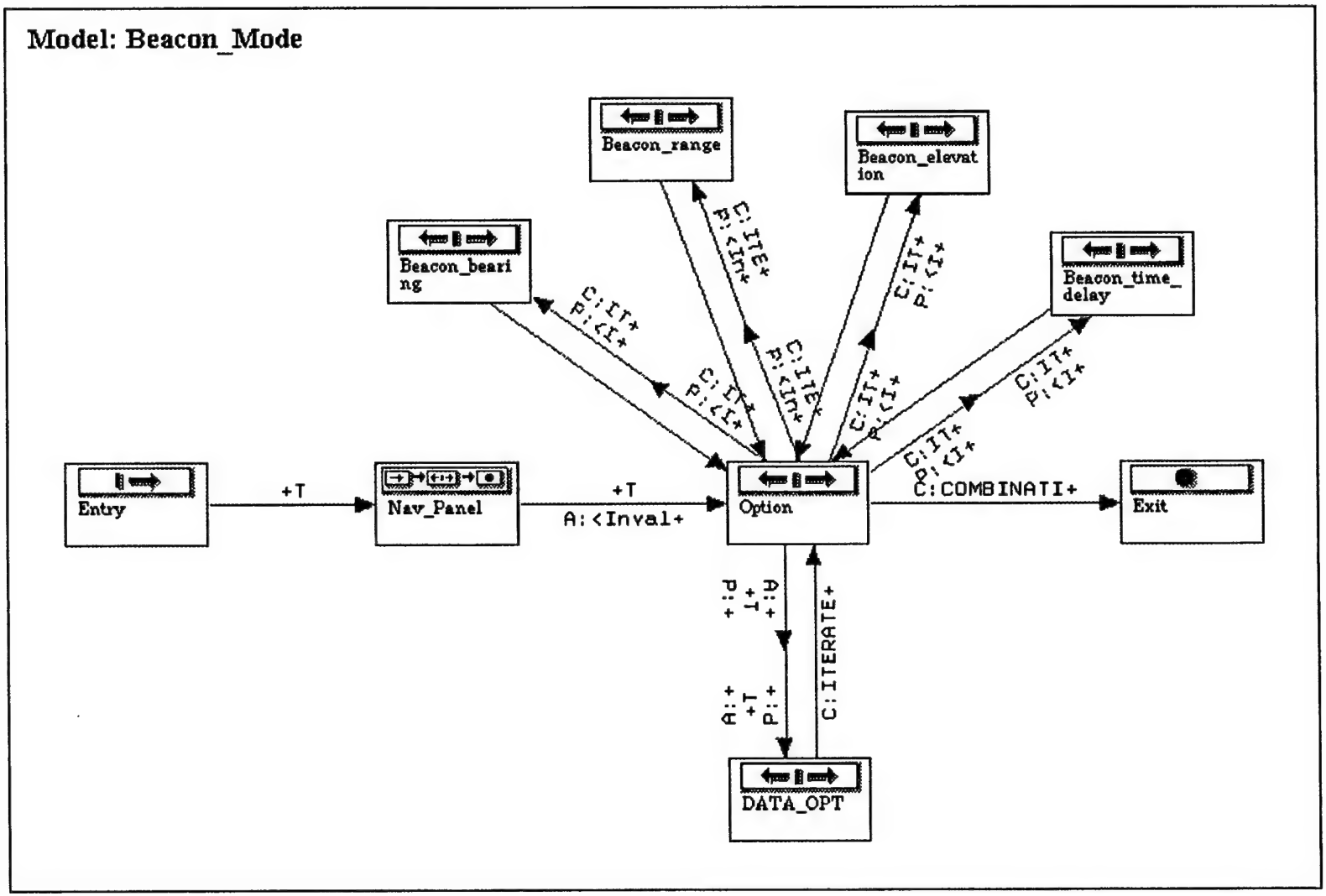

Model: Enter_Peng_Waypt2_Data
long
el
lat
waypoint_num
Entry
x
Exit
DATA_OPT
C:COMBINATION{1a+

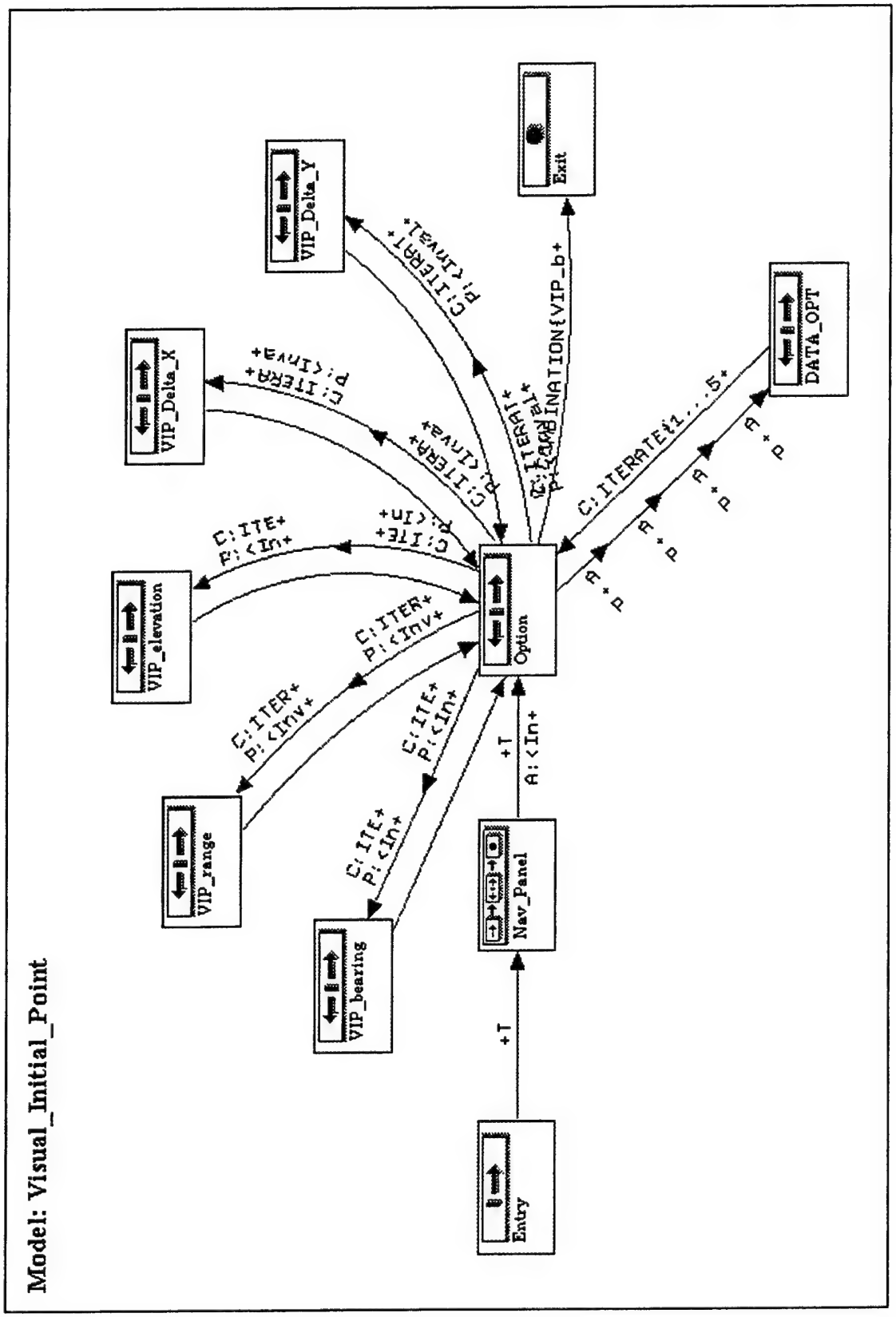

Model: Energy_Mgmt_Setup
Entry
Exit
Option
Home_Stgt_Selection
Fuel_Bingo
P:Fuel_Bingo1+
C:ITERAT+
P:INVSL1+
C:ITERAT+
P:AIVAIL+

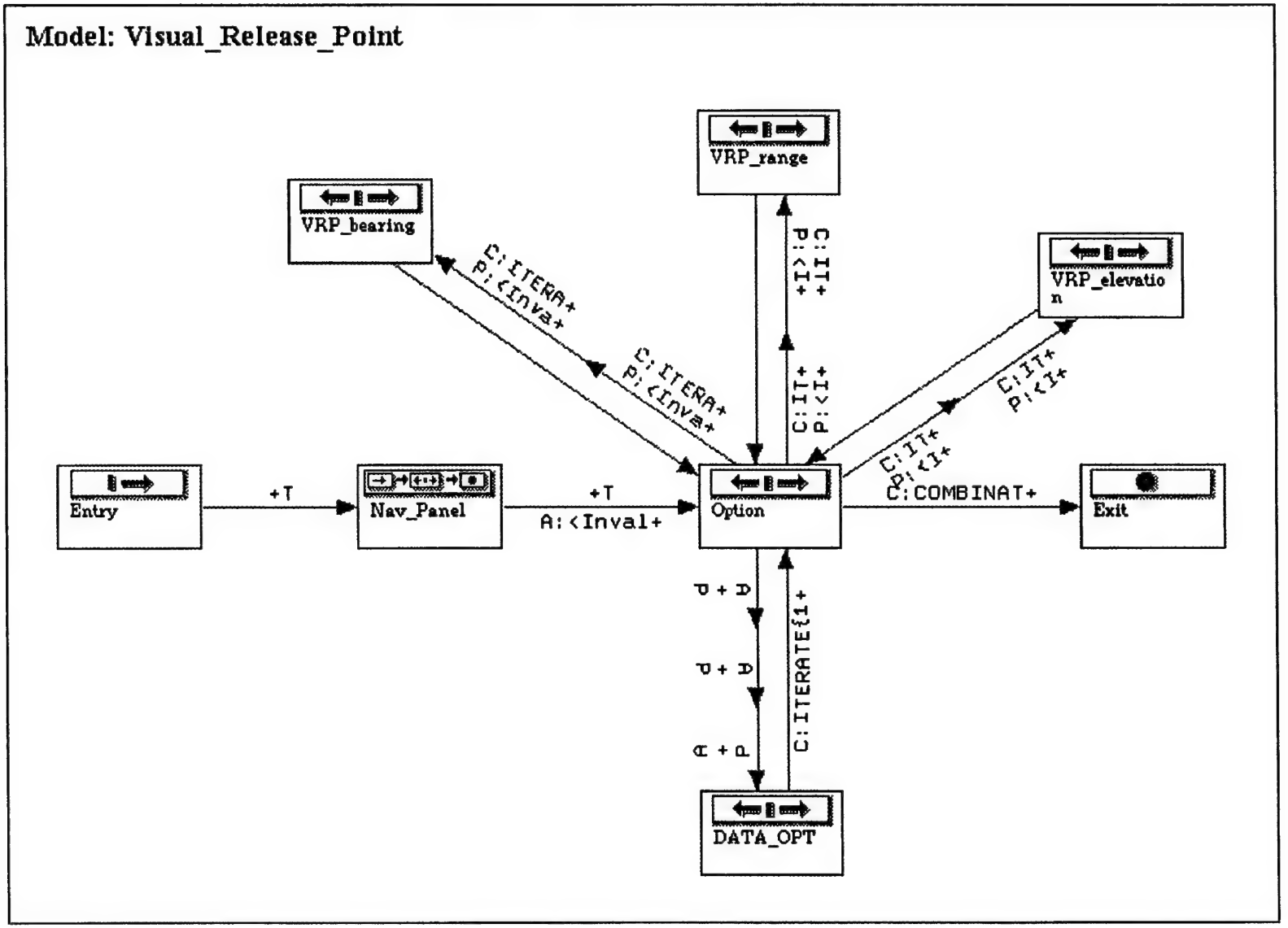

Model: Fuel_Bingo
DATA_OPT
*T
Pi*
*T
Pi*
*T
Entry
A:<In+
Nav_Panel
Fuel_Bingo_D
ata
Exit

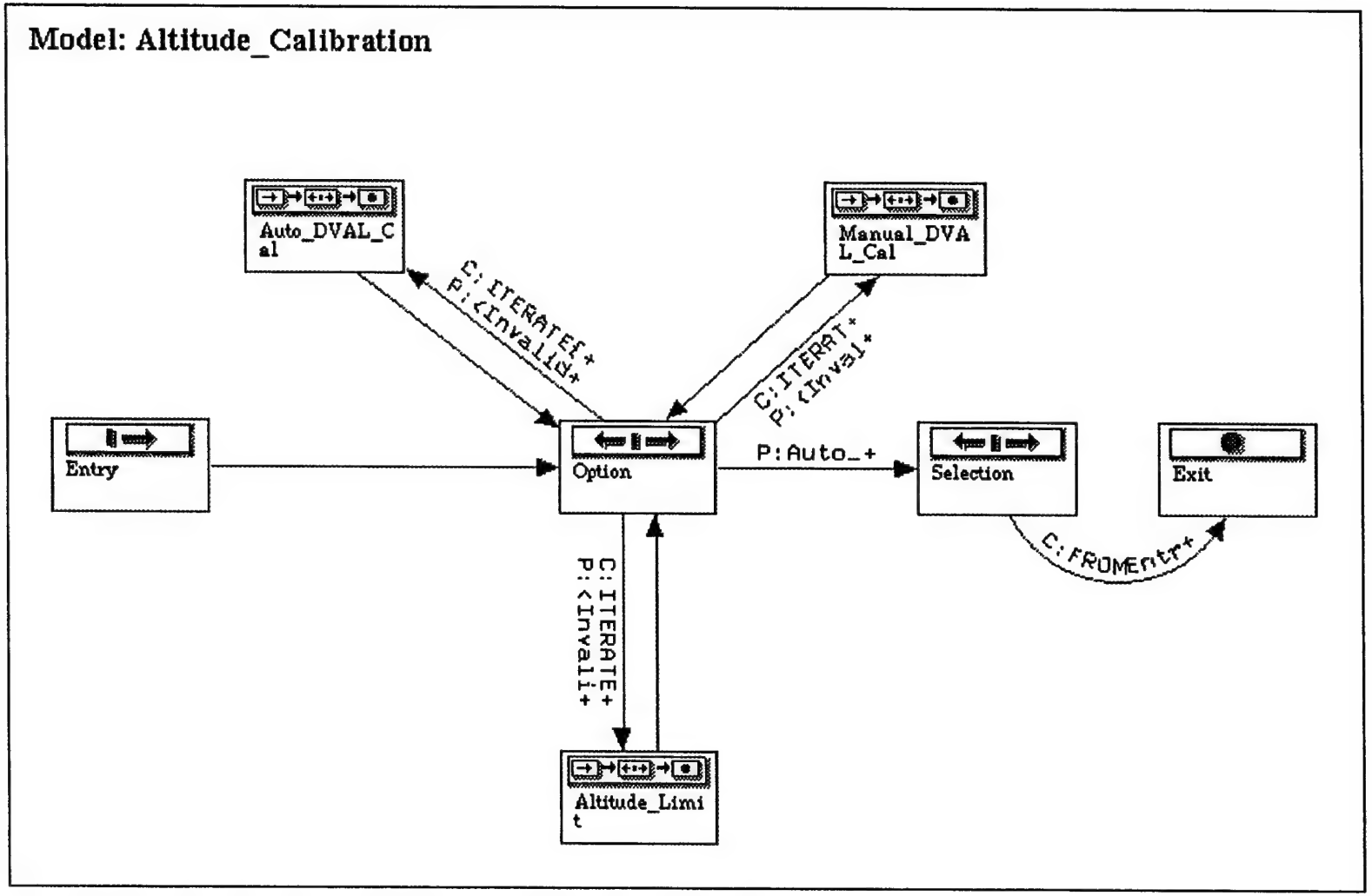

Model: Home_Stpt_Selection
Entry
Exit

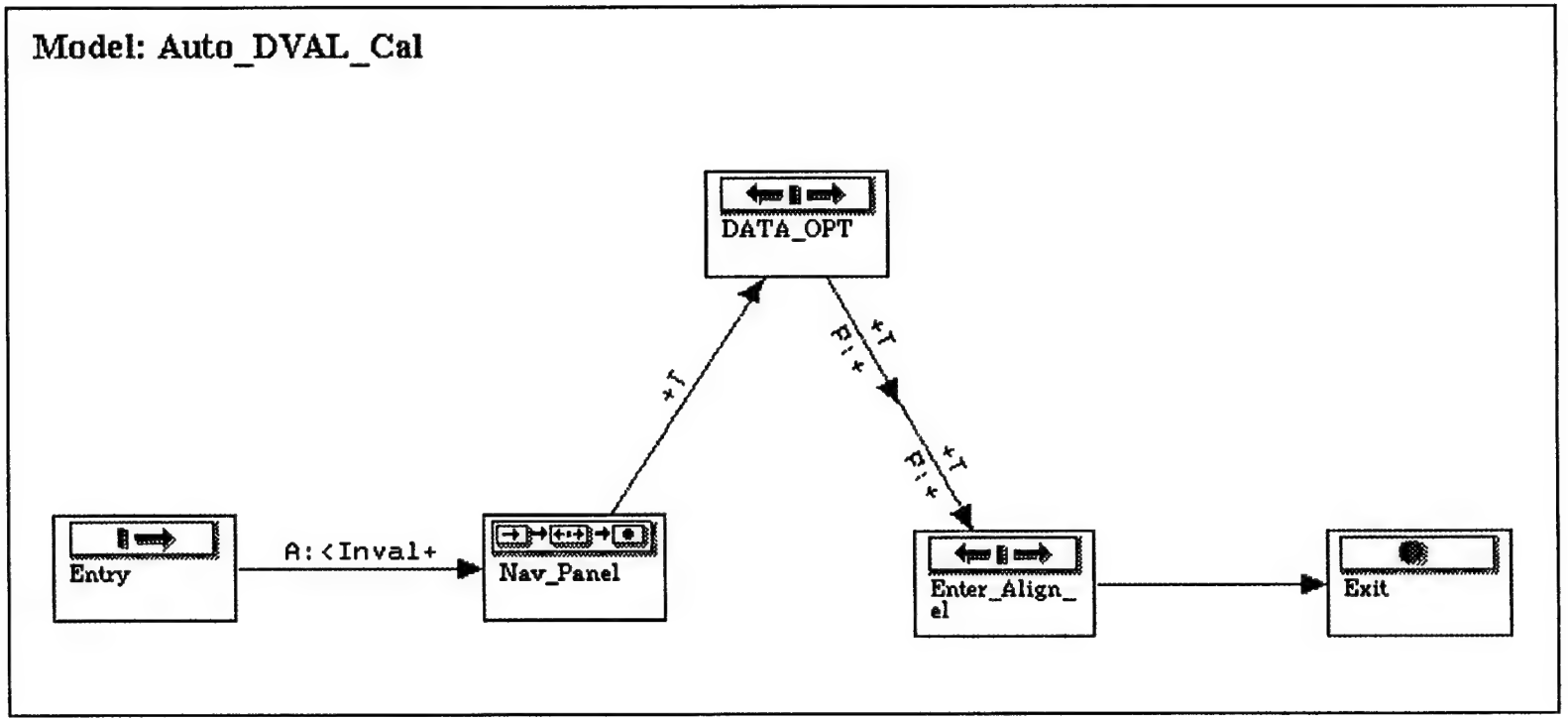

Model: Beacon_VIP_VRP
Visual_Initial_Point
Visual_Releas e_Point
C:ITERATE+*
P:<Invalid*
C:ITERATE+*
P:<Invalid *
Entry
Option
P:Vis+
selection
Exit
C:FROMEntry*
C:ITERATE+
P:<Invali+
Beacon_Mode

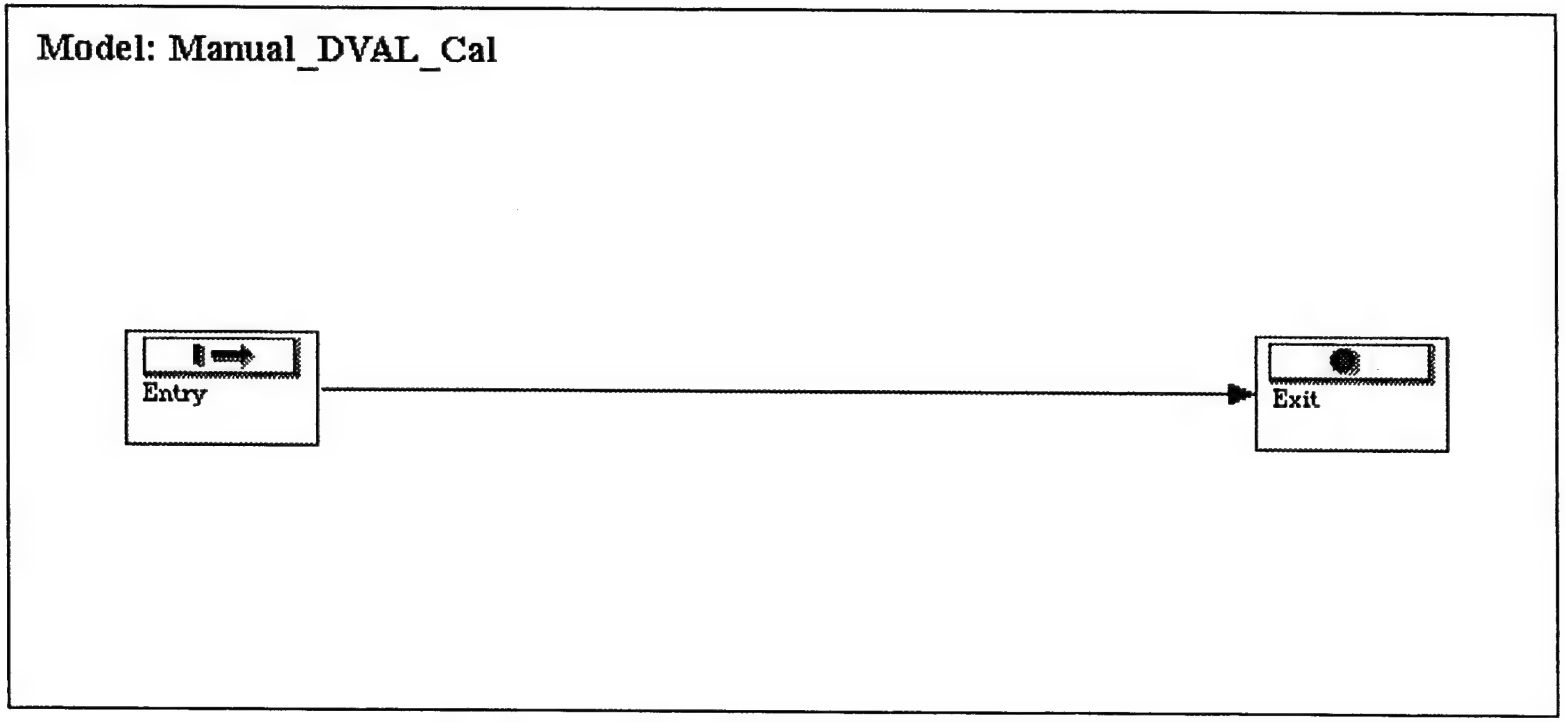

Model: Beacon_Mode
Beacon_range
Beacon_elevat ion
Beacon_beari ng
Beacon_time_ delay
C:IIE+ P:<In+
C:II+ P:<I+
Entry
+T
Nav_Panel
+T
A:<Inval+
Option
C:COMBINATI+
Exit
P:+ A:+ T
A:+ +T P:+
C:ITERATE+
DATA_OPT

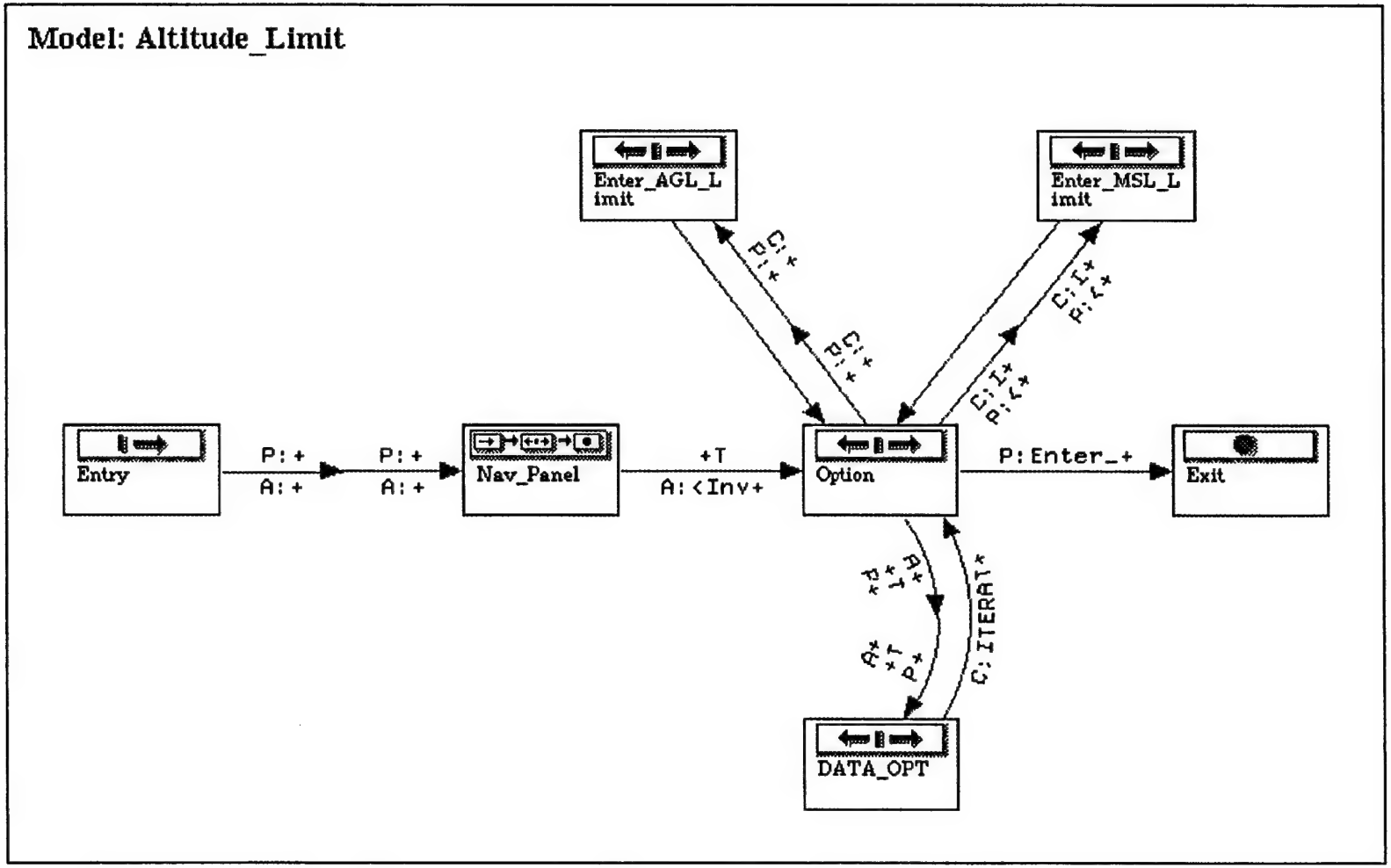

Model: Visual_Initial_Point
Entry
Exit
Option
Nav_Panel
VIP_range
VIP_bearing
VIP_elevation
VIP_Delta_X
VIP_Delta_Y
DATA_OPT
+T
A:<In+
C:ITE+
P:<In+
C:ITER+
P:<Inv+
C:ITERAT+
P:<Inval+
C:ITERATE{1...5*
A*P

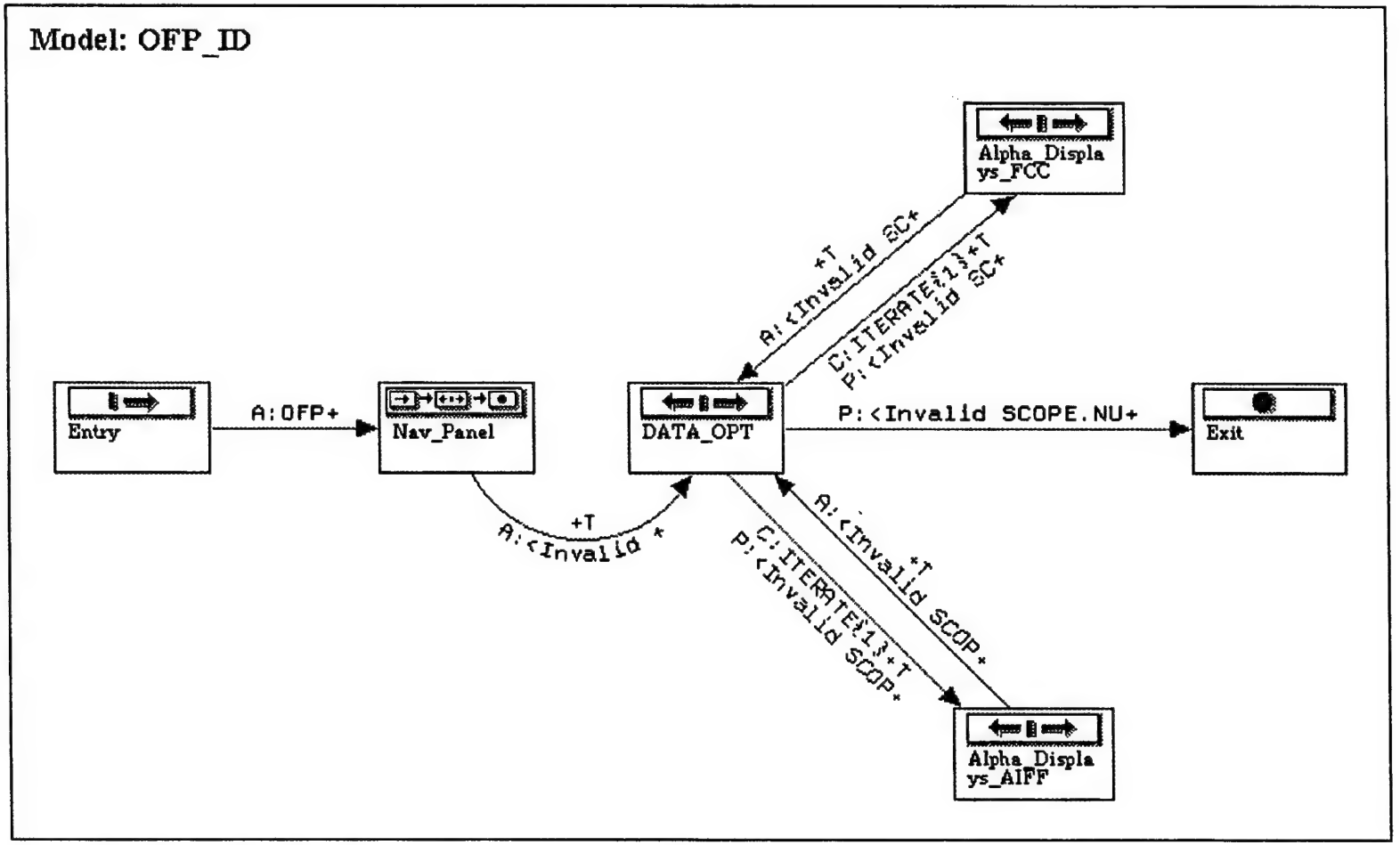

Model: Visual_Release_Point
VRP_range
VRP_bearing
VRP_elevation
Entry
Nav_Panel
Option
Exit
DATA_OPT
+T
+T
A:<Inval+
C:COMBINAT+
C:ITERA+
P:<Inva+
C:ITERA+
P:<Inva+
C:IT+
P:<I+
C:IT+
P:<I+
C:IT+
P:<I+
C:IT+
P:<I+
C:ITERATE{1+

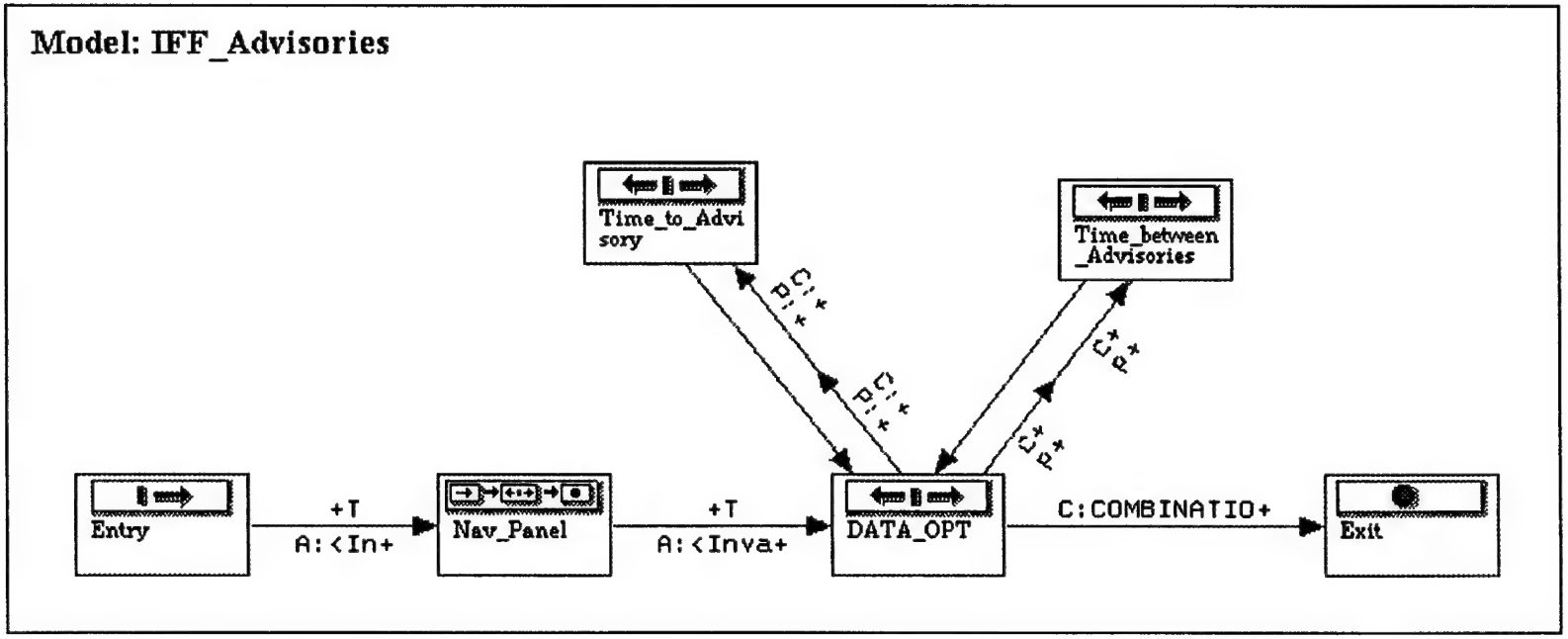

Model: Altitude_Calibration
Auto_DVAL_Cal
Manual_DVAL_Cal
C: ITERATE+
P: <Invali+
C: ITERAT+
P: <Inval+
Entry
Option
P: Auto_+
Selection
Exit
C: FROMEntr+
C: ITERATE+
P: <Invali+
Altitude_Limit

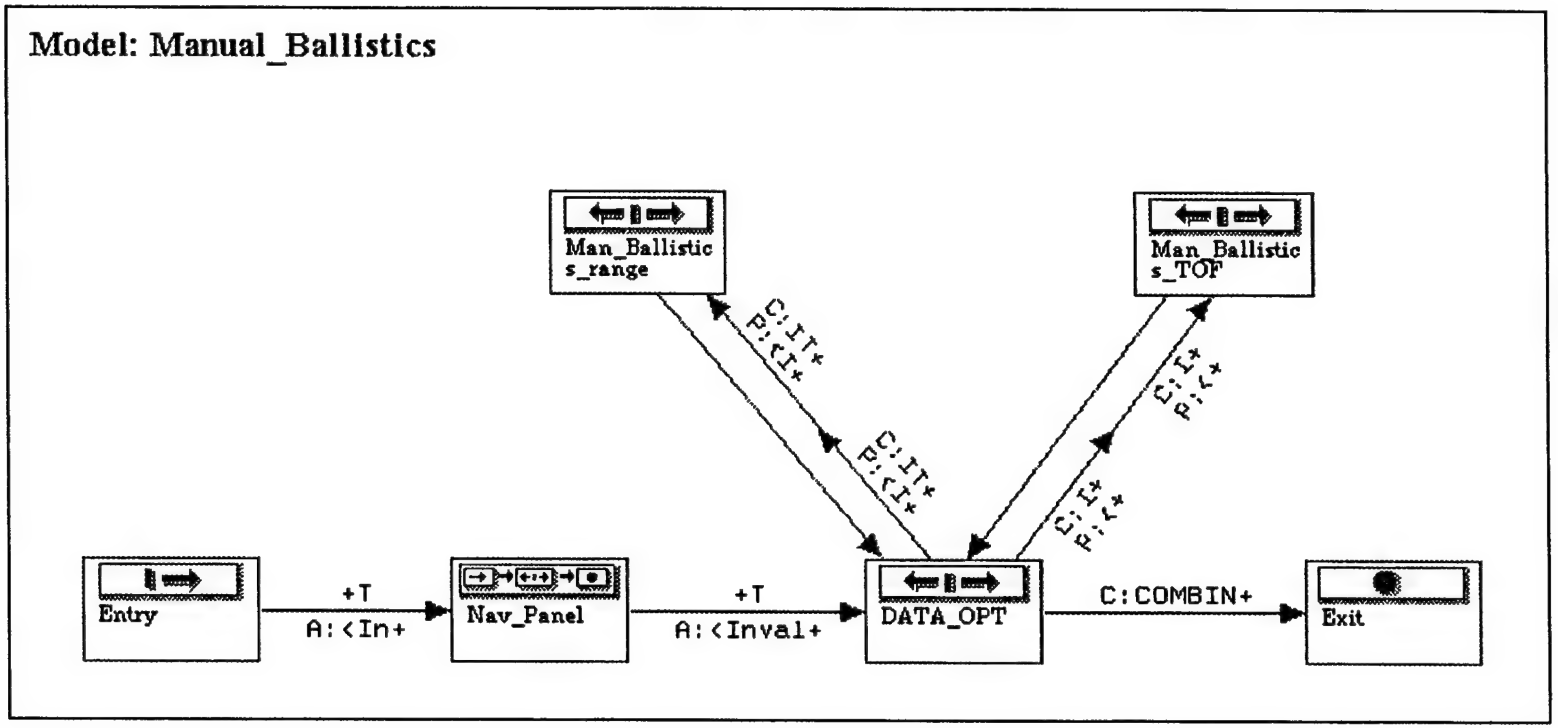

Model: Auto_DVAL_Cal
DATA_OPT
Entry
A:<Inval+
Nav_Panel
Enter_Align_
el
Exit

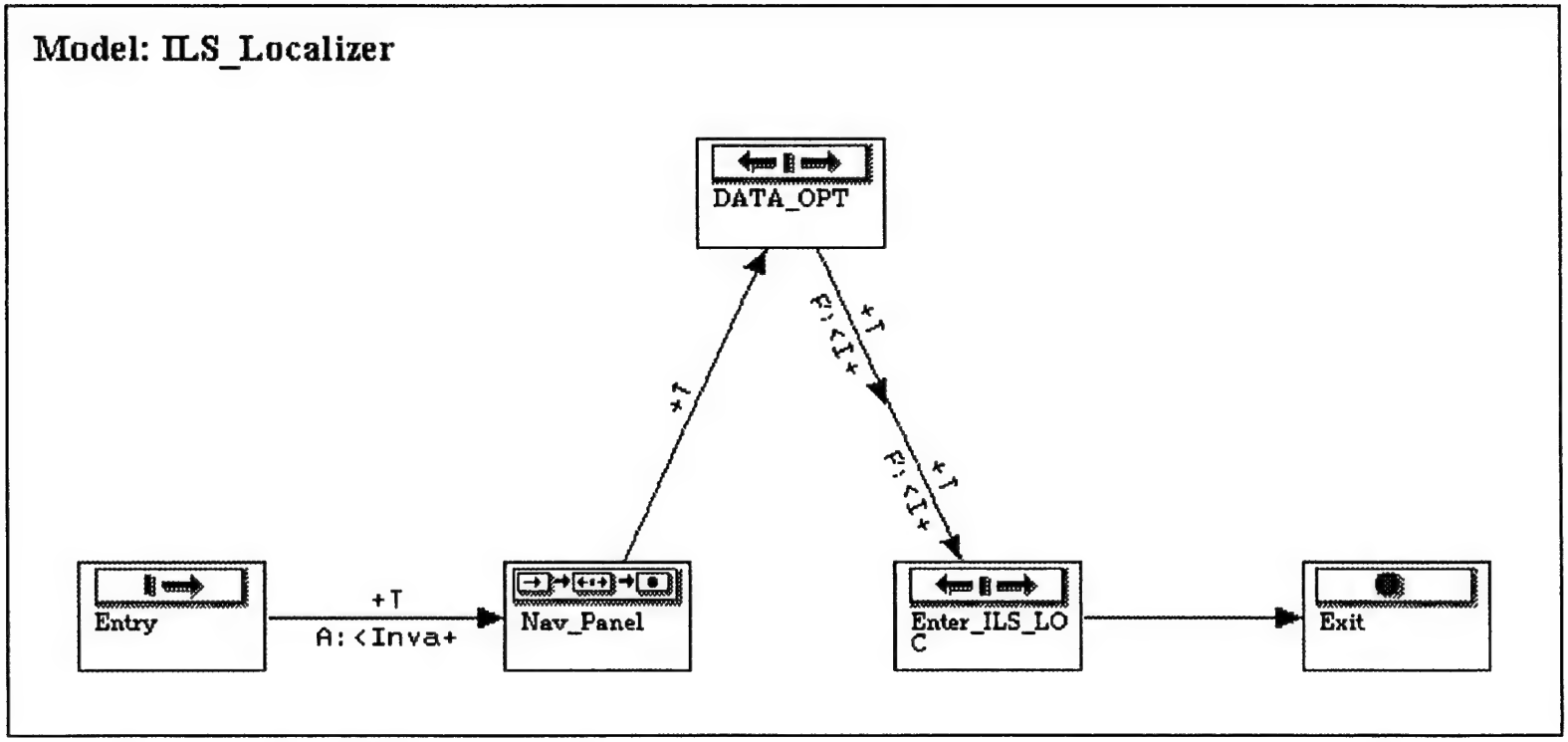

Model: Manual_DVAL_Cal
Entry
Exit

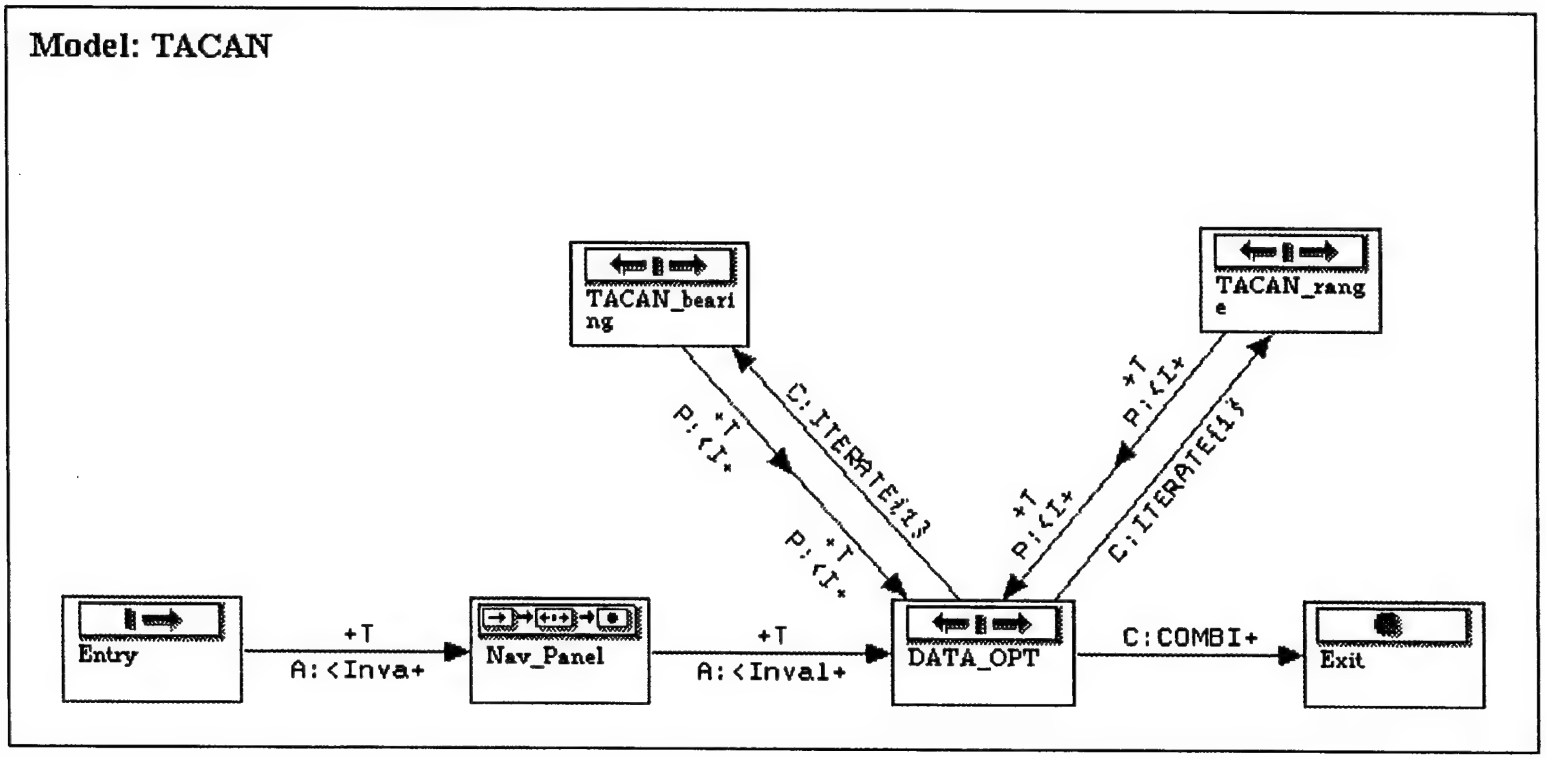

Model: Altitude_Limit
Enter_AGL_L imit
Enter_MSL_L imit
C: *
P: *
C: *
P: *
C: I*
P: I*
C: I*
P: I*
Entry
P: +
A: +
P: +
A: +
Nav_Panel
+T
A: <Inv+
Option
P: Enter_+
Exit
A*
P*
T
A*
P*
T
C: ITERAT*
DATA_OPT

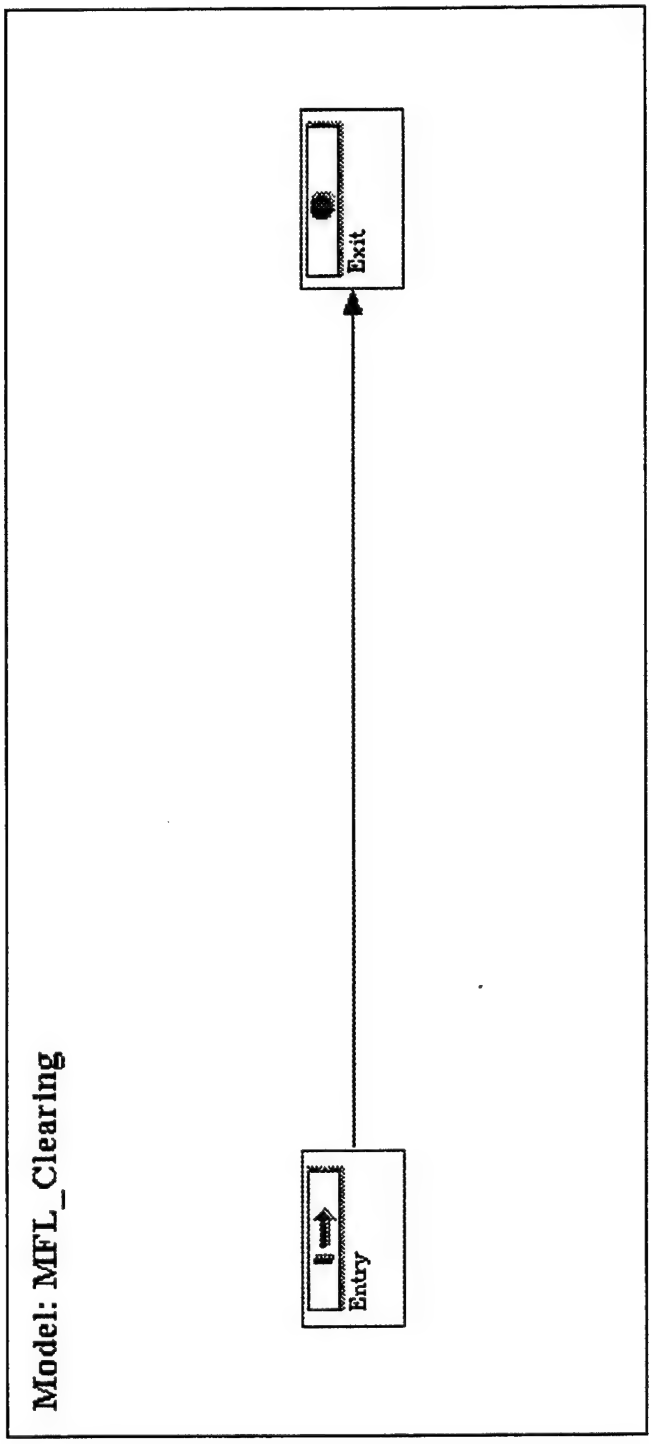

Model: OFP_ID
Entry
A:OFP+
Nav_Panel
DATA_OPT
P:<Invalid SCOPE.NU+
Exit
Alpha_Displays_FCC
Alpha_Displays_AIFF
A:<Invalid SC+ +T
C:ITERATE[1,1]+T
P:<Invalid SC+
A:<Invalid * +T
C:ITERATE[1,1]+T
P:<Invalid SCOP+
A:<Invalid SCOP+ +T

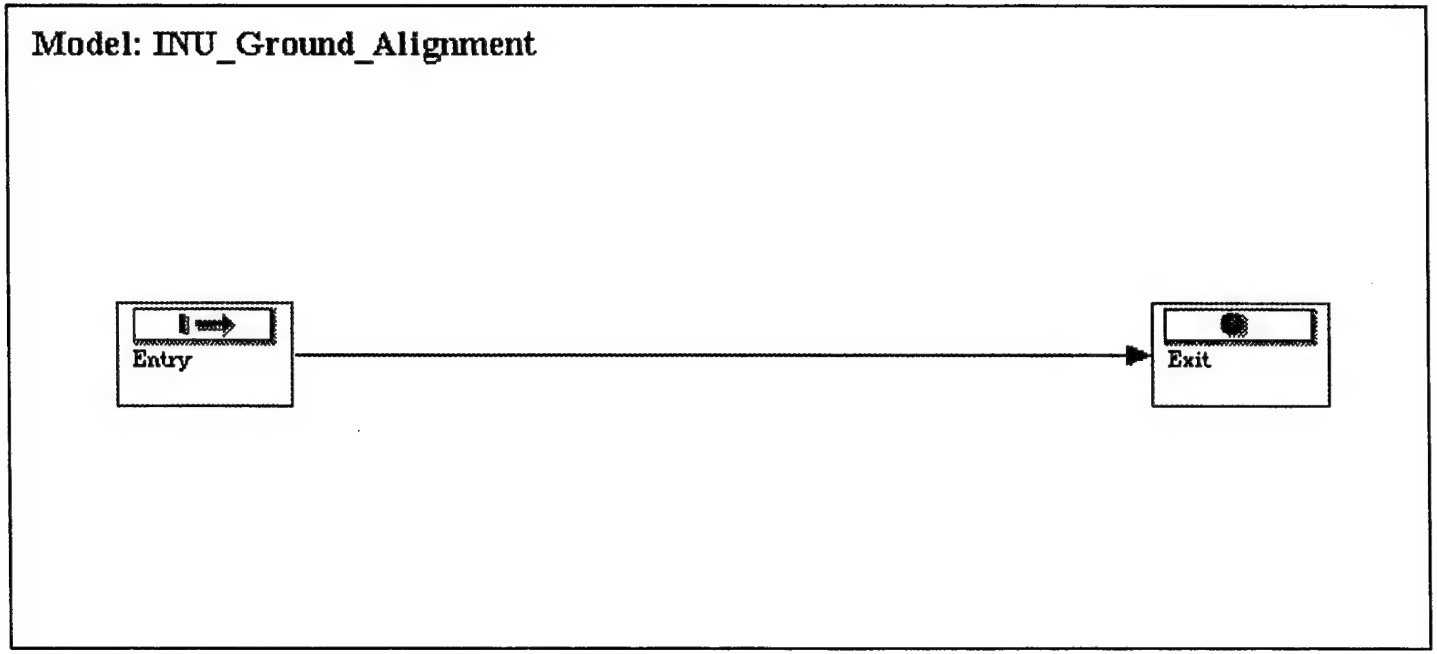

Model: IFF_Advisories
Time_to_Advi sory
Time_between _Advisories
Entry
+T
A:<In+
Nav_Panel
+T
A:<Inva+
DATA_OPT
C:COMBINATIO+
Exit

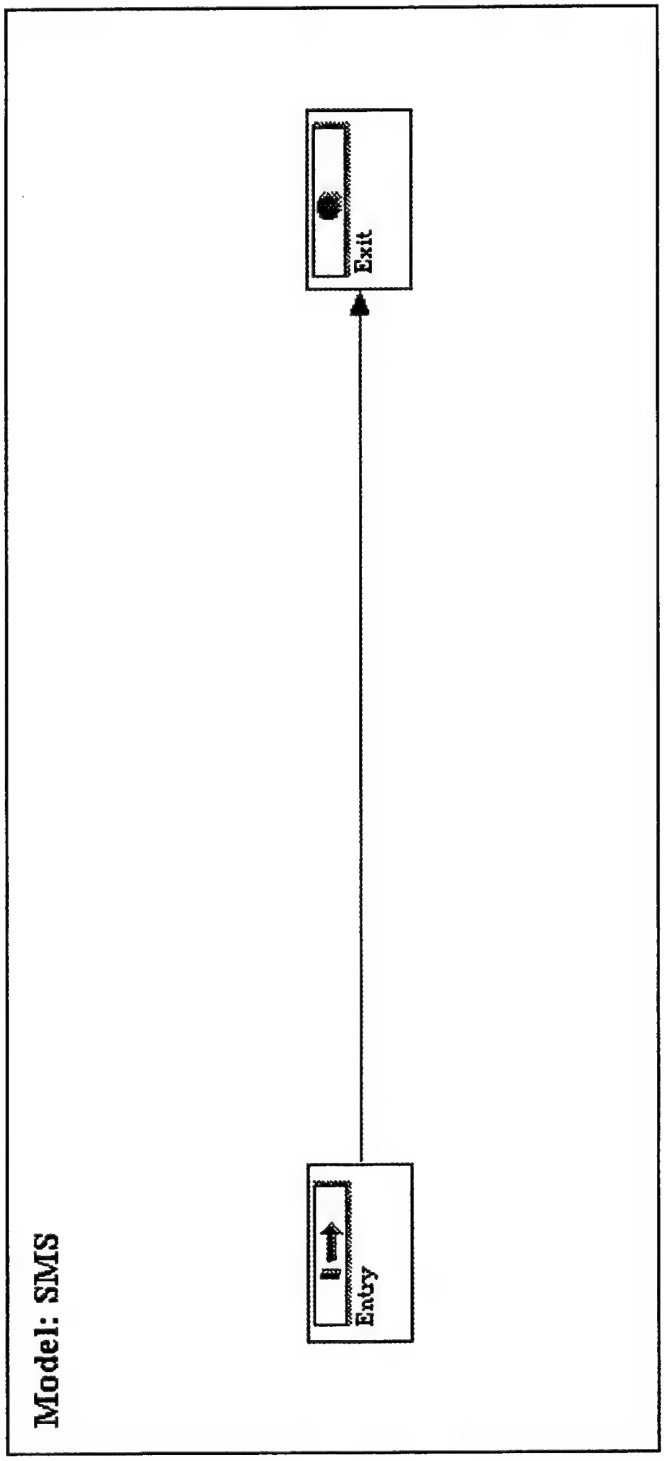

Model: Manual_Ballistics
Man_Ballistic s_range
Man_Ballistic s_TOF
C:IT+ P:<I+
C:IT+ P:<I+
C:I+ P:<I+
C:I+ P:<I+
Entry
+T
A:<In+
Nav_Panel
+T
A:<Inval+
DATA_OPT
C:COMBIN+
Exit

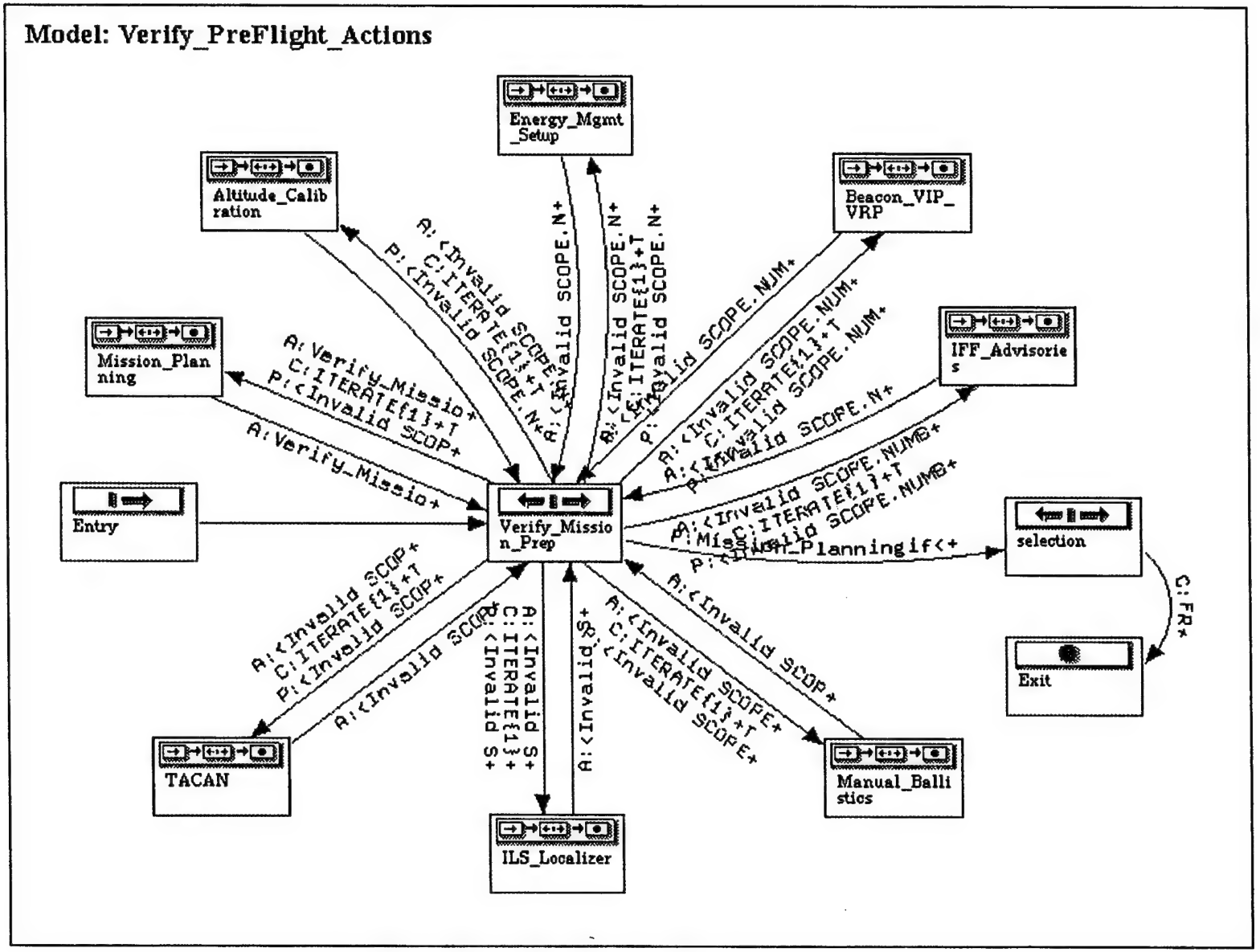

Model: ILS_Localizer
DATA_OPT
+T
F:<I+
+T
F:<I+
+T
Entry
+T
A:<Inva+
Nav_Panel
Enter_ILS_LO
C
Exit

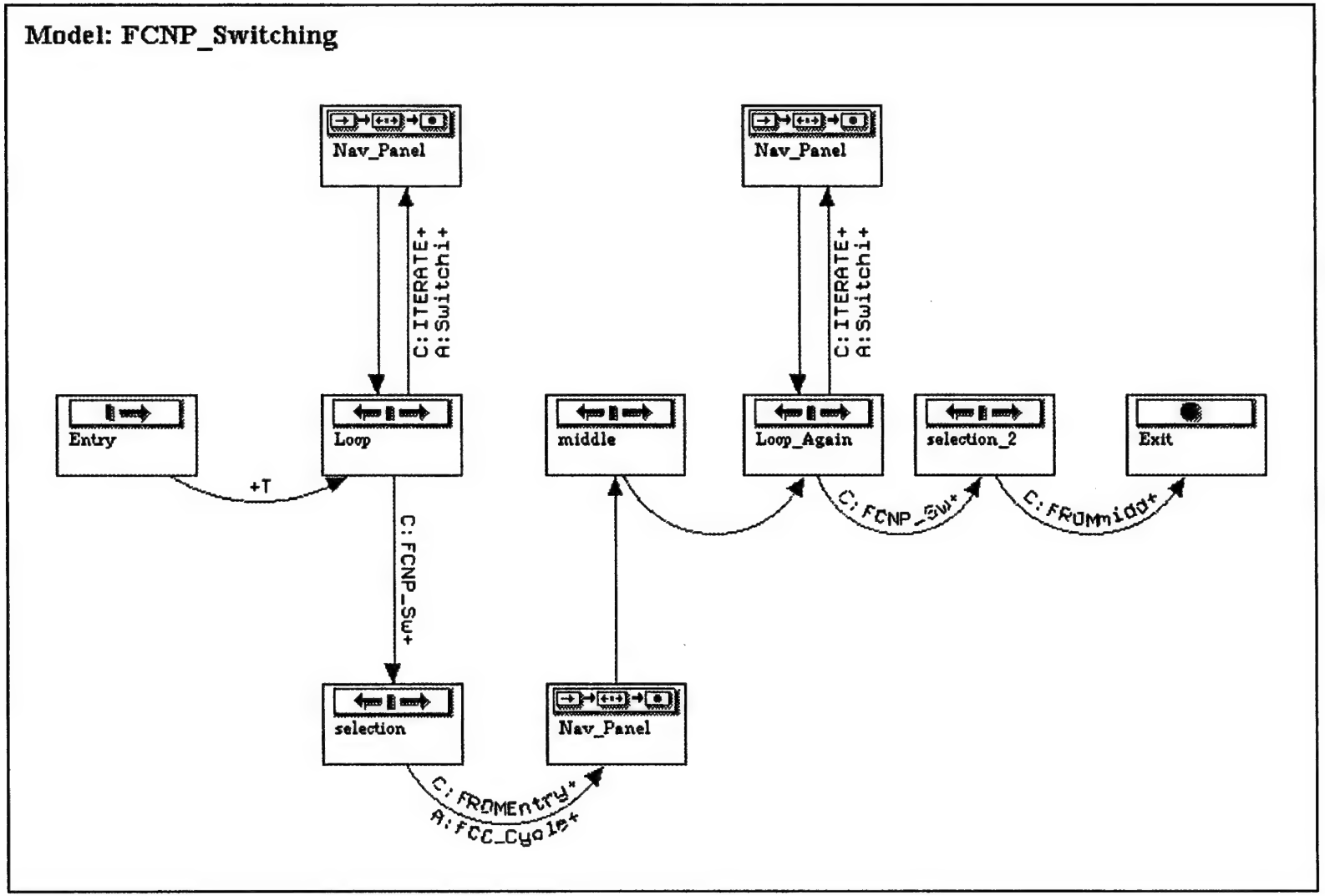

Model: TACAN
TACAN_bearing
TACAN_range
C:ITERATE{1}
+T
P:<I+
+T
P:<I+
+T
P:<I+
+T
P:<I+
C:ITERATE{1}
Entry
+T
A:<Inva+
Nav_Panel
+T
A:<Inval+
DATA_OPT
C:COMBI+
Exit


Model: MFL_Clearing
Entry
Exit

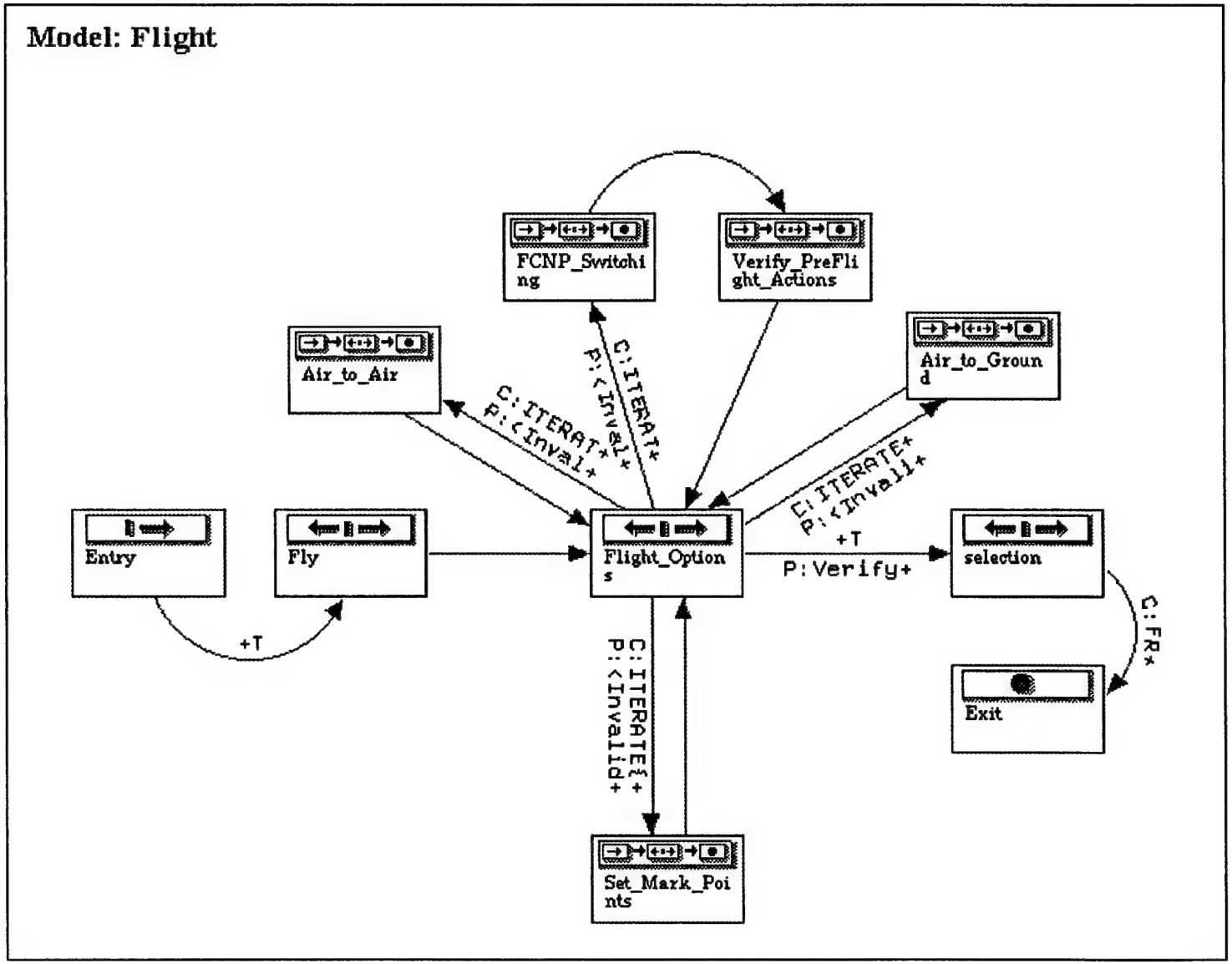

Model: INU_Ground_Alignment
Entry
Exit

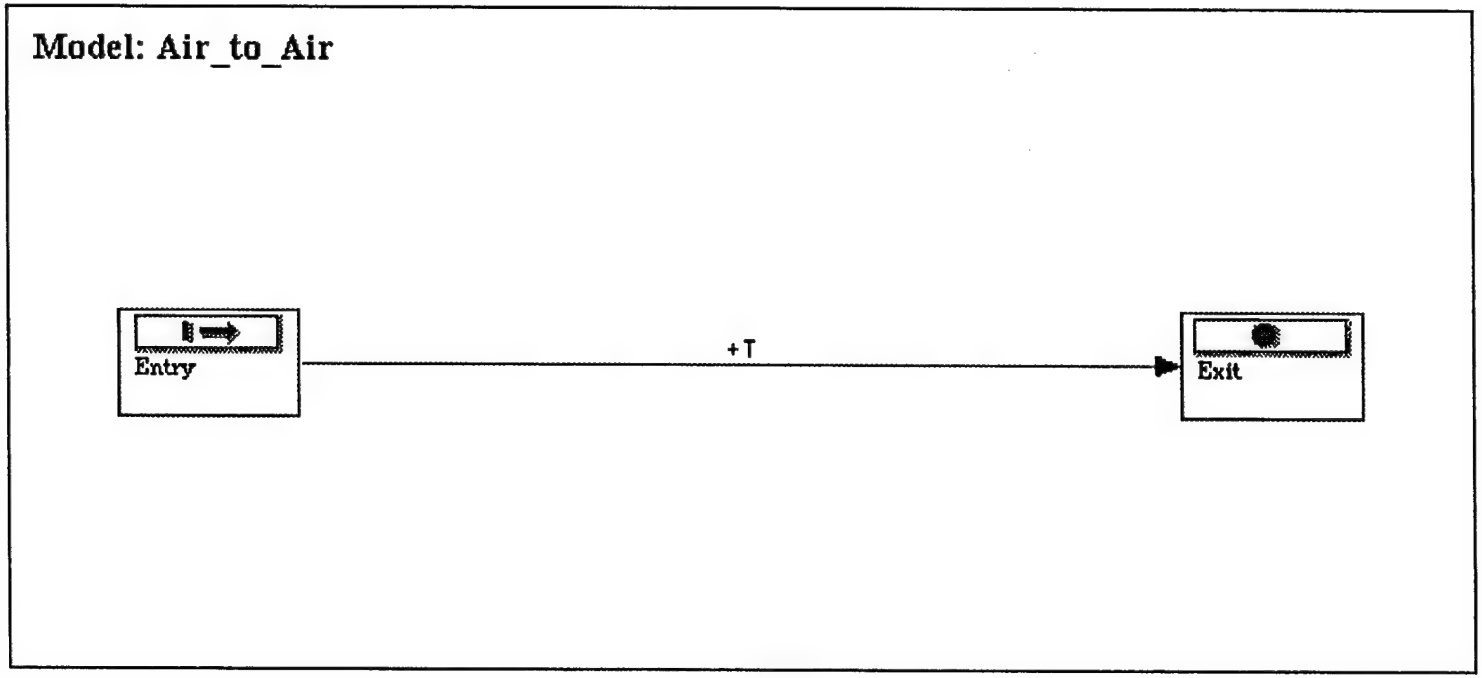

Model: SMS
Entry
Exit

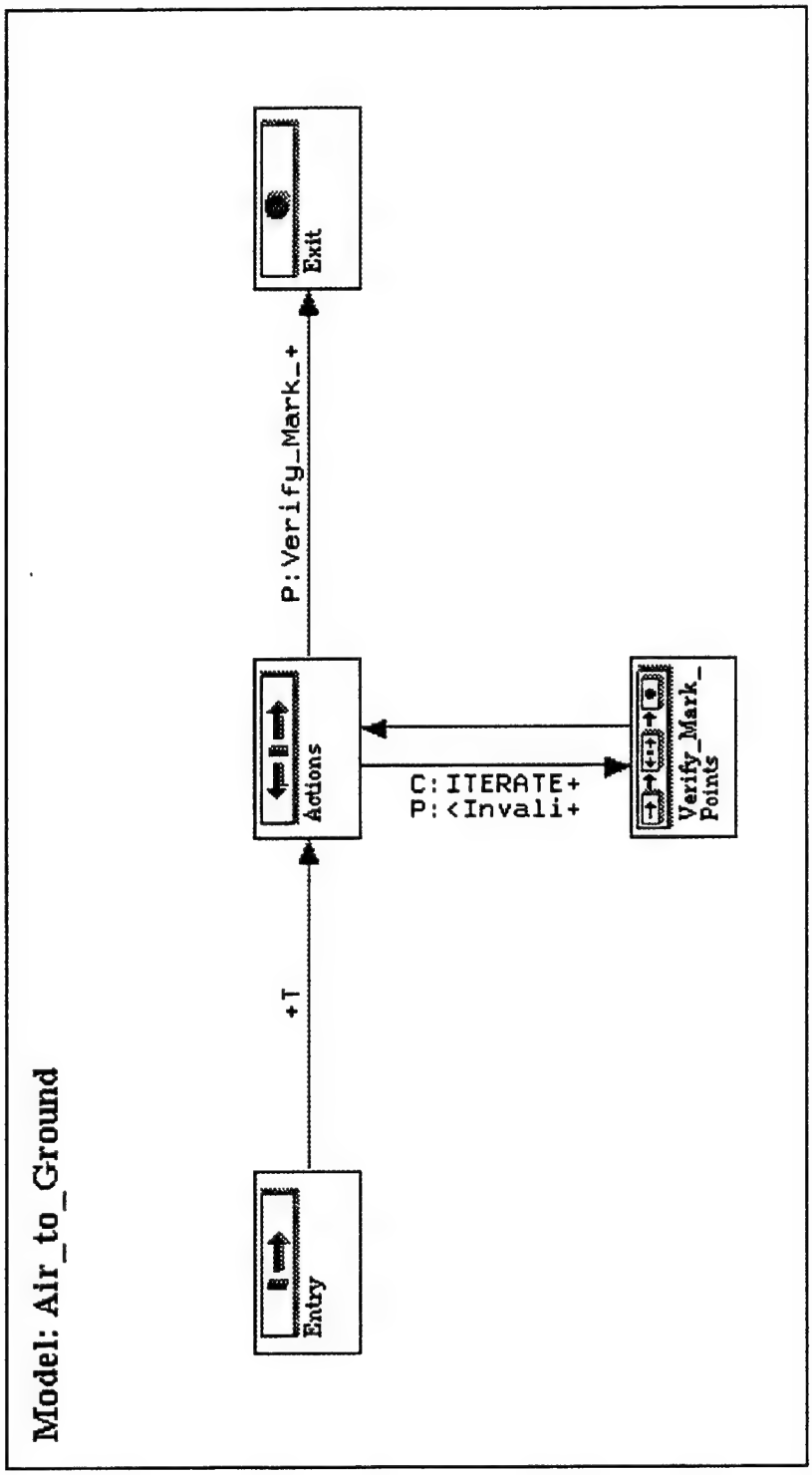

Model: Verify_PreFlight_Actions
Energy_Mgmt_Setup
Altitude_Calibration
Beacon_VIP_VRP
Mission_Planning
IFF_Advisories
Entry
Verify_Mission_Prep
selection
Exit
TACAN
ILS_Localizer
Manual_Ballistics

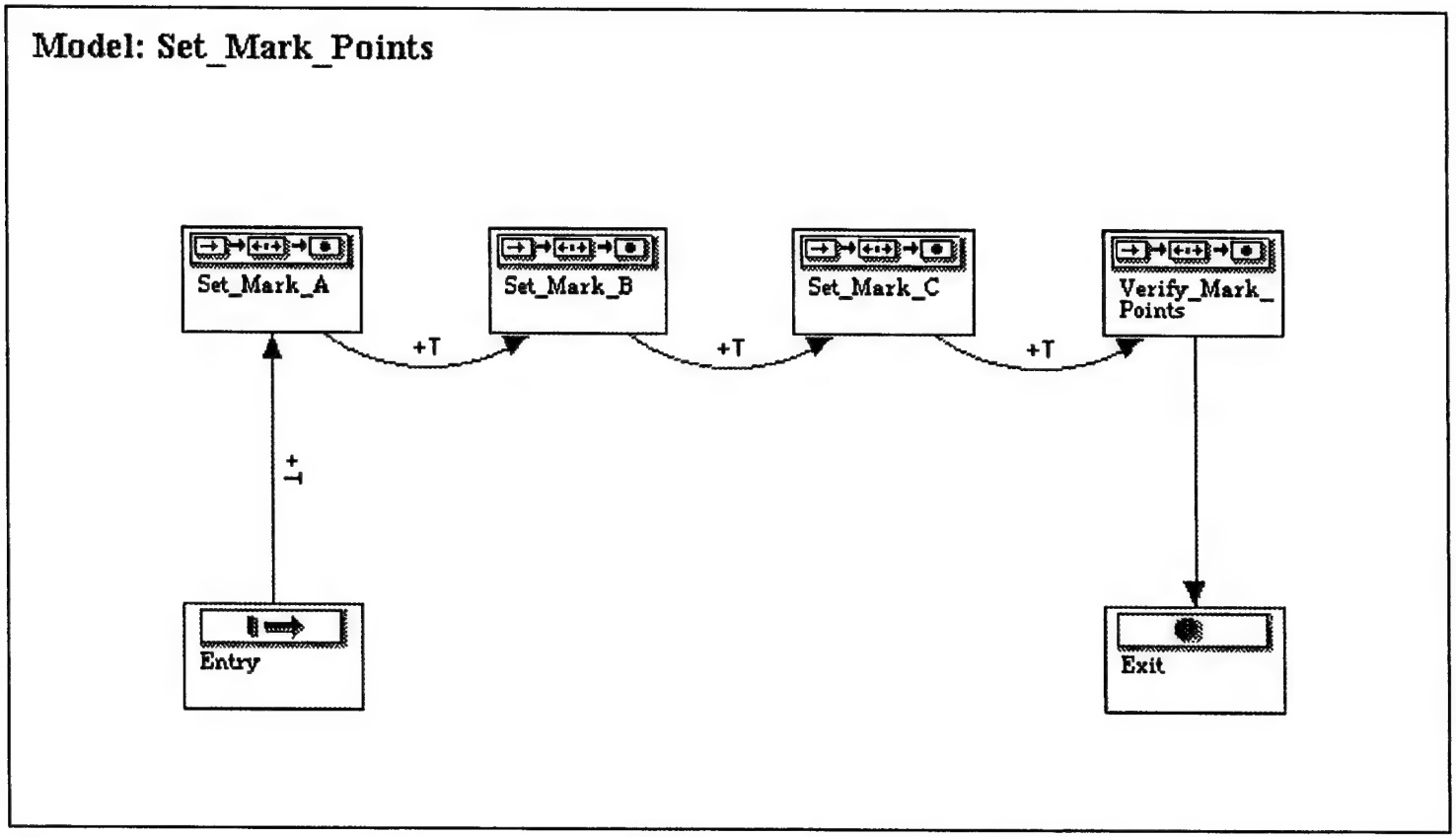

Model: FCNP_Switching
Nav_Panel
Nav_Panel
C: ITERATE+
A: Switch+
C: ITERATE+
A: Switch+
Entry
Loop
middle
Loop_Again
selection_2
Exit
+T
C: FCNP_Sw+
C: FCNP_Sw+
C: FROMmid0+
selection
Nav_Panel
C: FROMEntry*
A: FCC_Cycle+

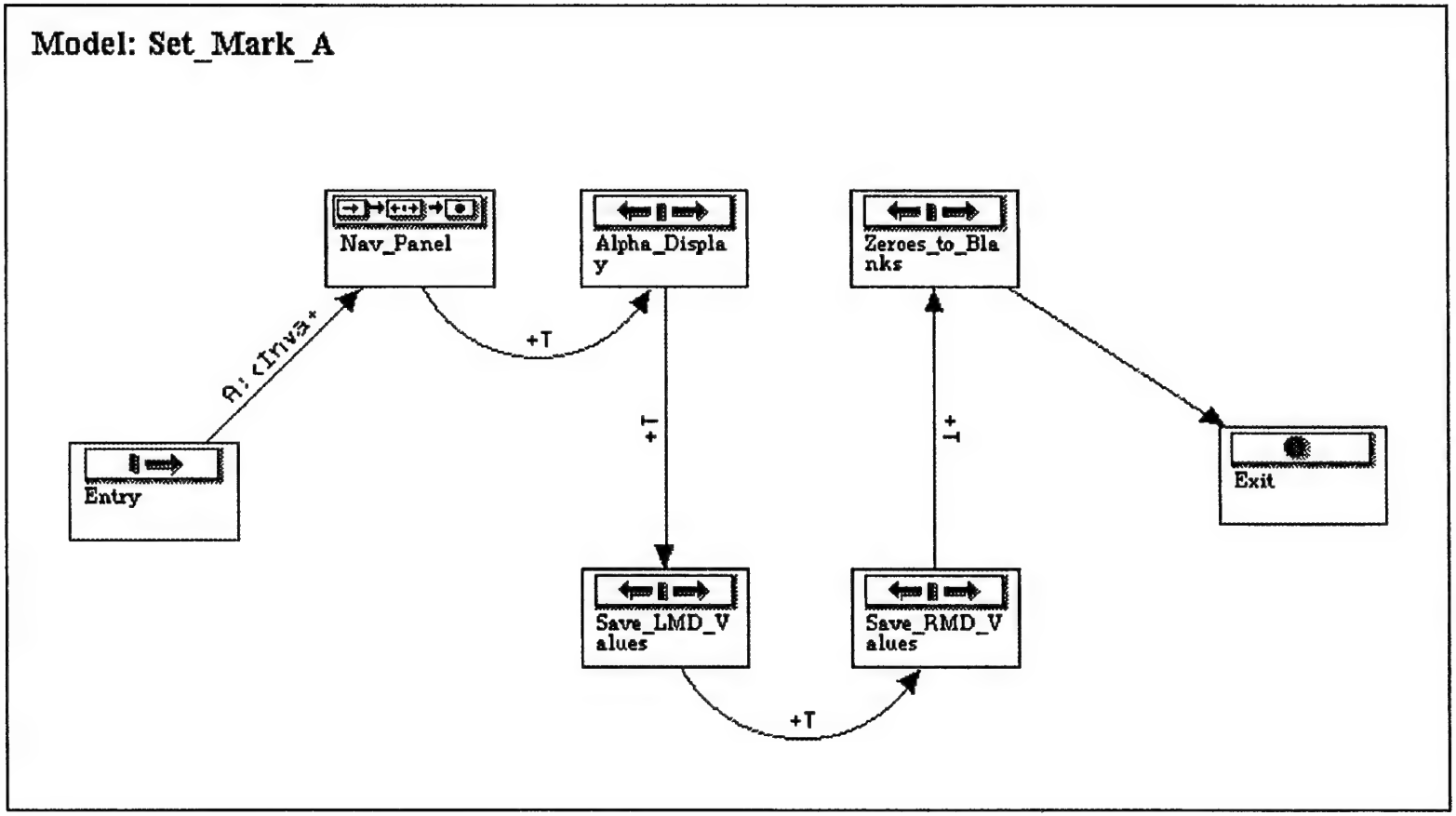
Model: TakeOff
Entry
+T
Exit

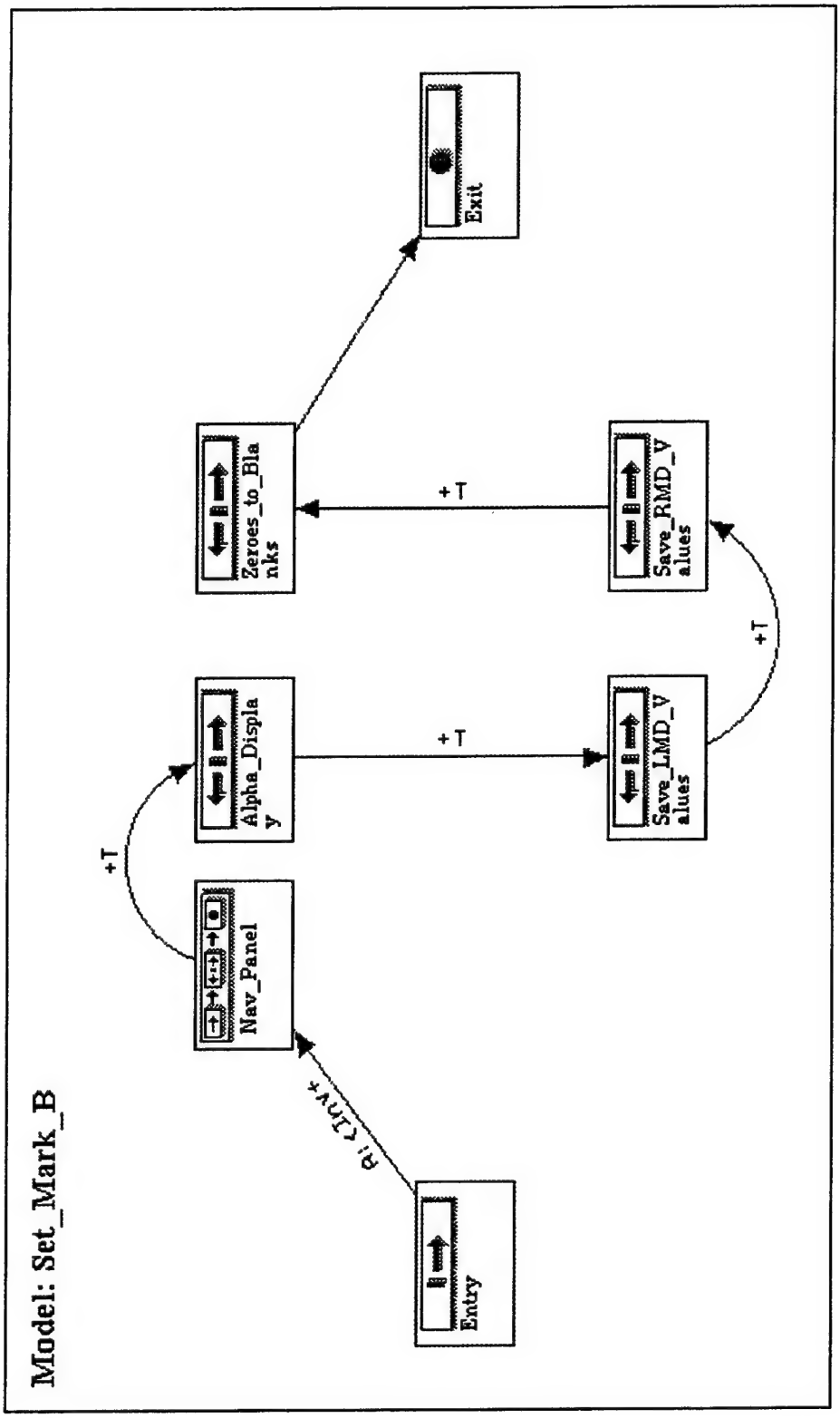

Model: Flight
FCNP_Switchi ng
Verify_PreFli ght_Actions
Air_to_Air
Air_to_Groun d
C:ITERAT+ P:<Inval+
C:ITERAT+ P:<Inval+
C:ITERATE+ P:<Invali+
Entry
Fly
Flight_Option s
+T
P:Verify+
selection
C:FR+
+T
C:ITERATE+ P:<Invalid+
Exit
Set_Mark_Poi nts

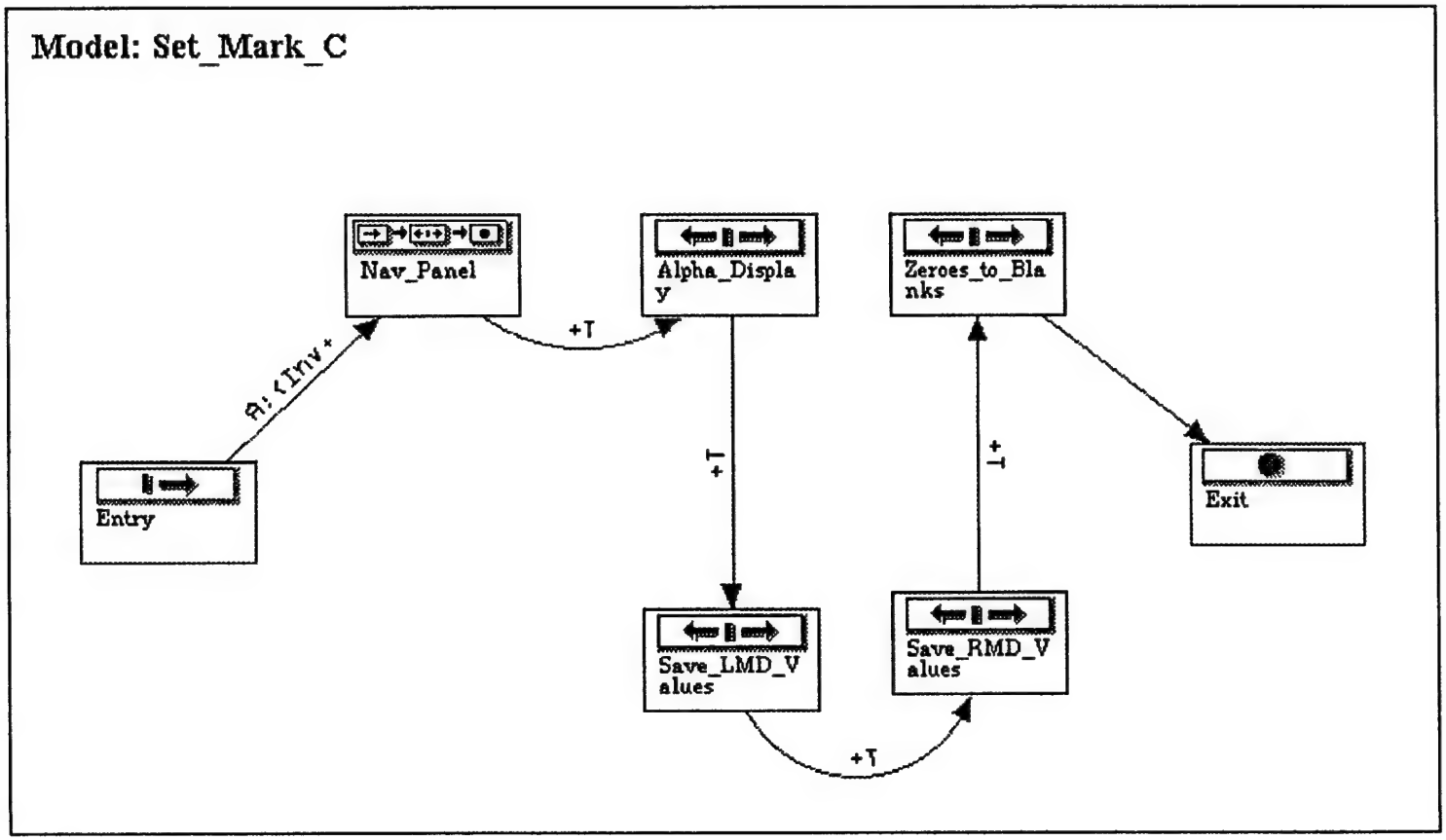

Model: Air_to_Air
Entry
+T
Exit

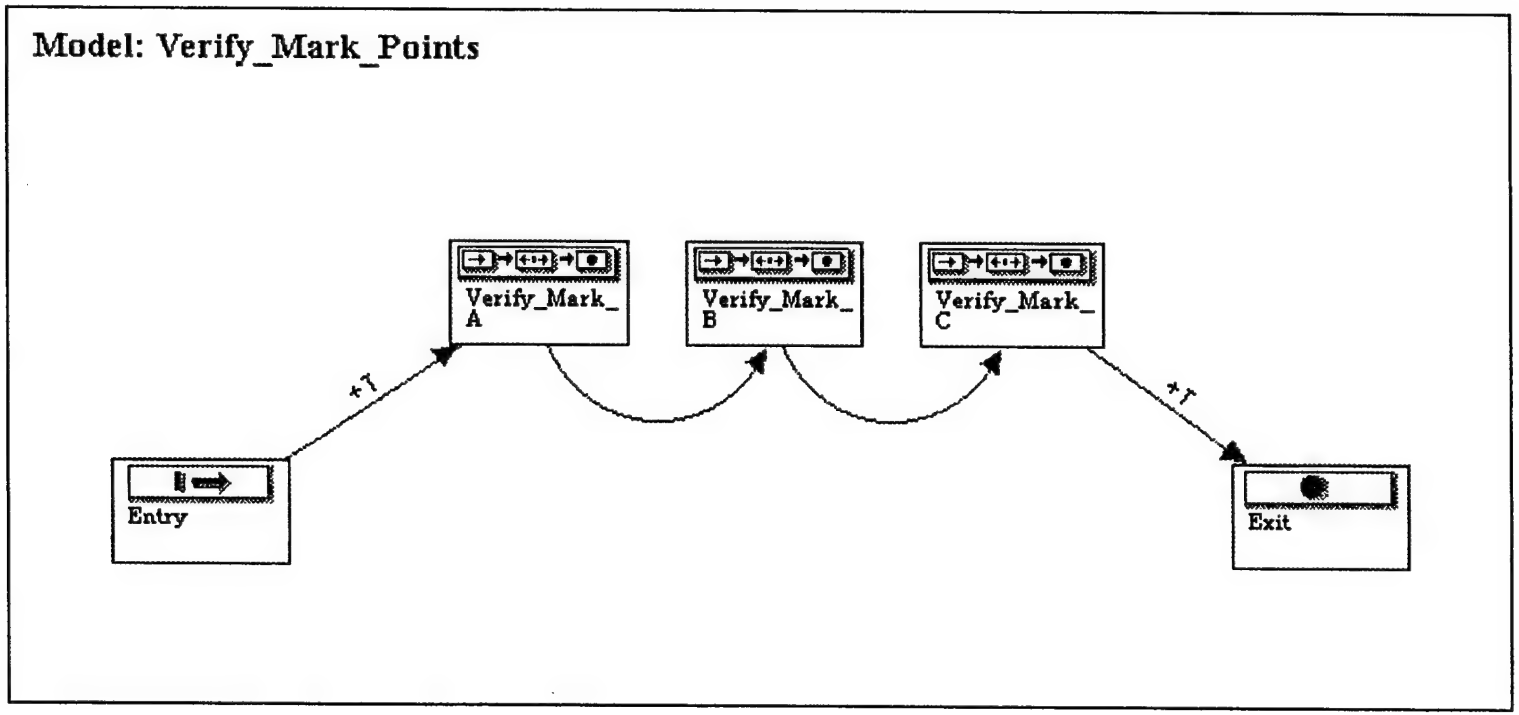

Model: Air_to_Ground
Entry
+T
Actions
P:Verify_Mark_+
Exit
C:ITERATE+
P:<Invali+
Verify_Mark_
Points

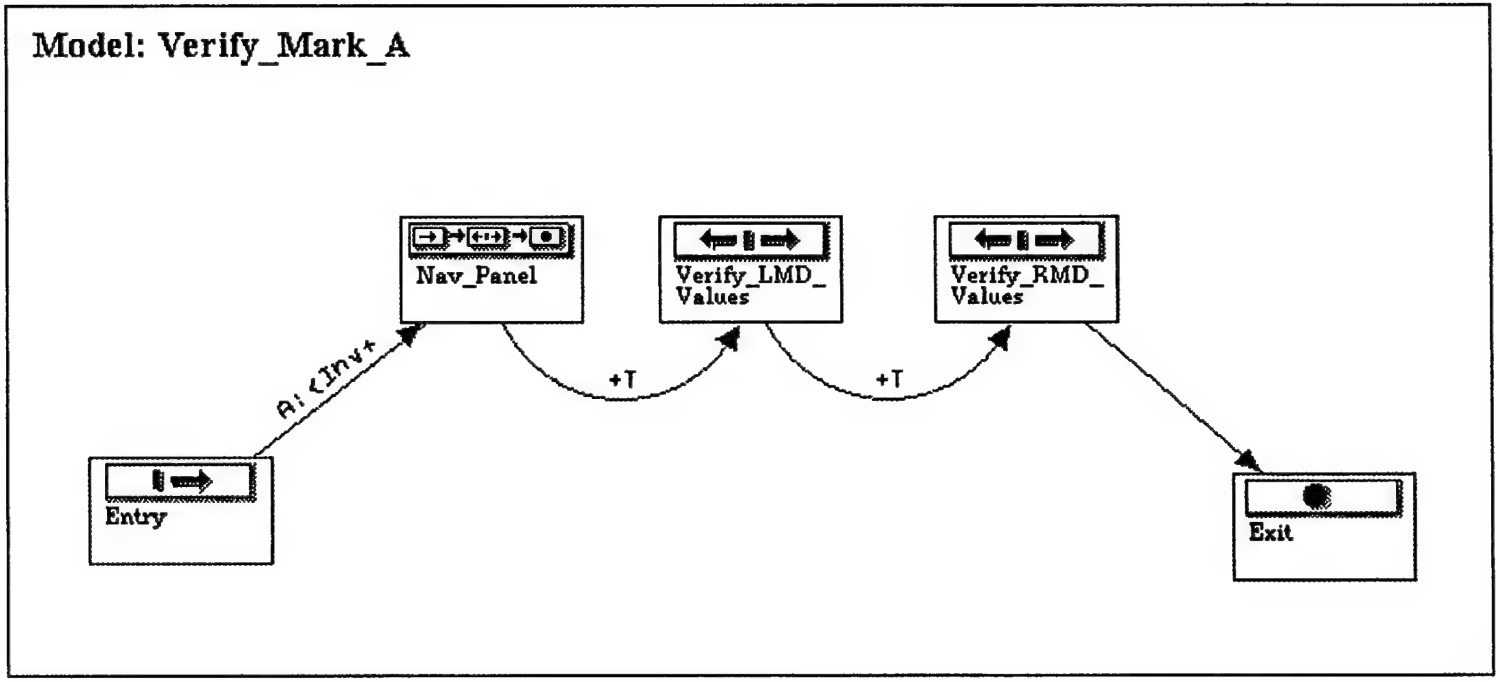

Model: Set_Mark_Points
Set_Mark_A
Set_Mark_B
Set_Mark_C
Verify_Mark_
Points
+T
+T
+T
+T
Entry
Exit

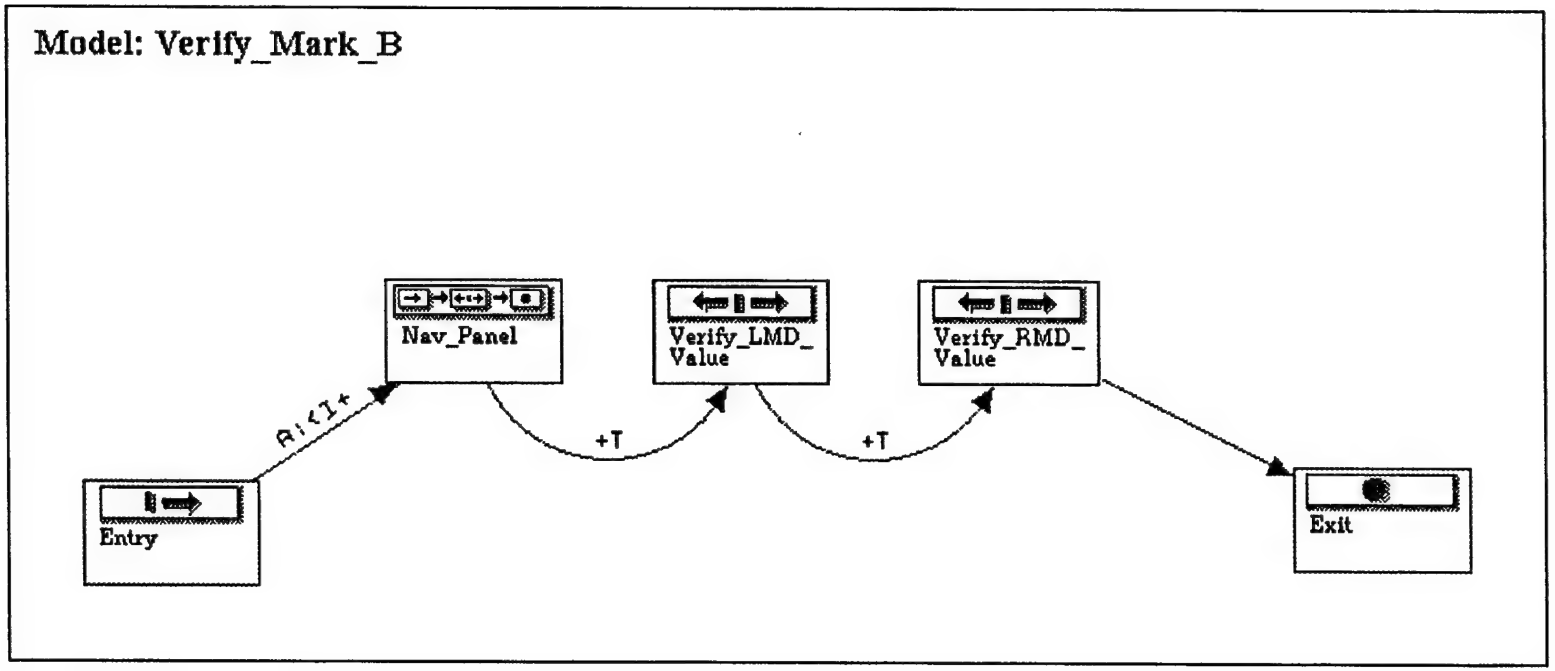

Model: Set_Mark_A
Nav_Panel
Alpha_Displa
y
Zeroes_to_Bla
nks
A: <Inva*
+T
+T
+T
Entry
Exit
Save_LMD_V
alues
Save_RMD_V
alues
+T

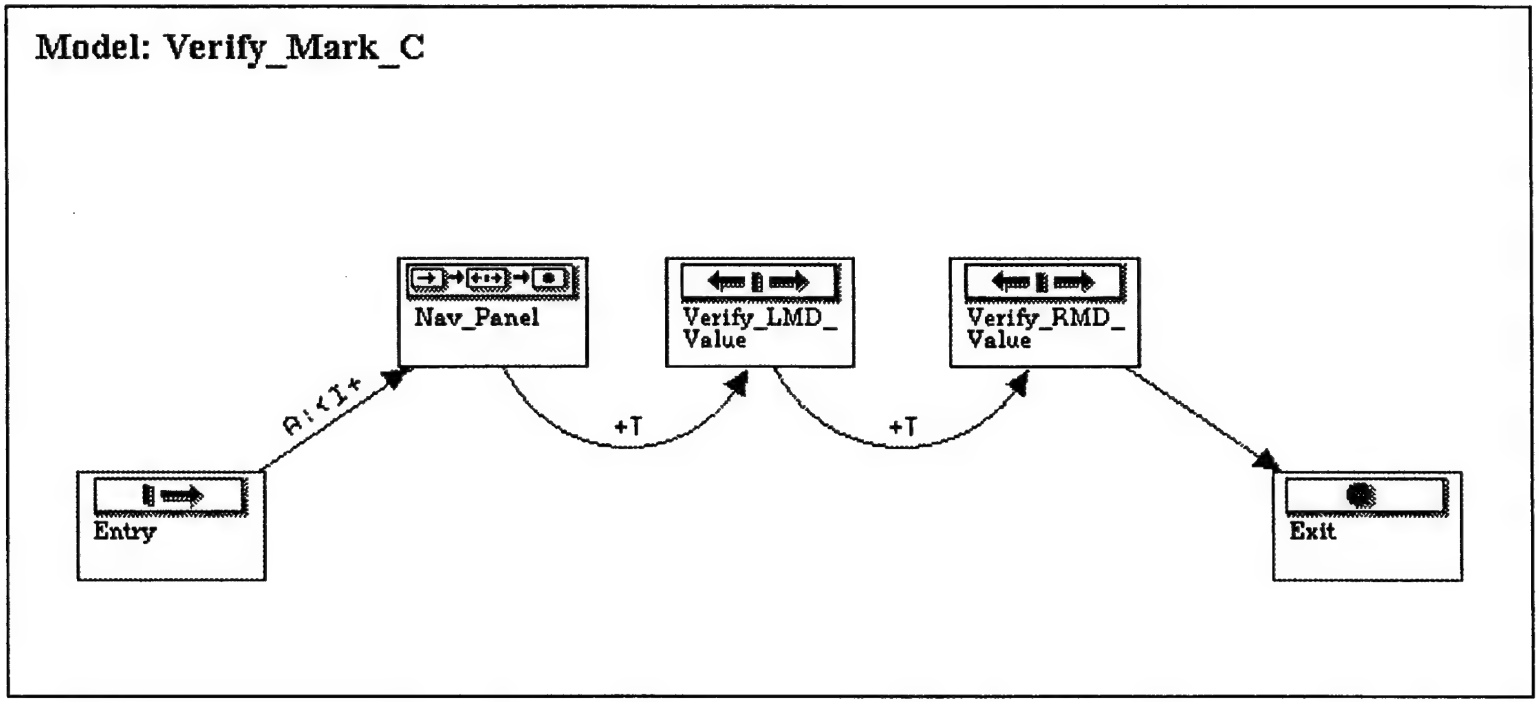

Model: Set_Mark_B
Entry
Al_Clnv+
Nav_Panel
+T
Alpha_Displa
y
+T
Save_LMD_V
alues
+T
Save_RMD_V
alues
+T
Zeroes_to_Bla
nks
Exit

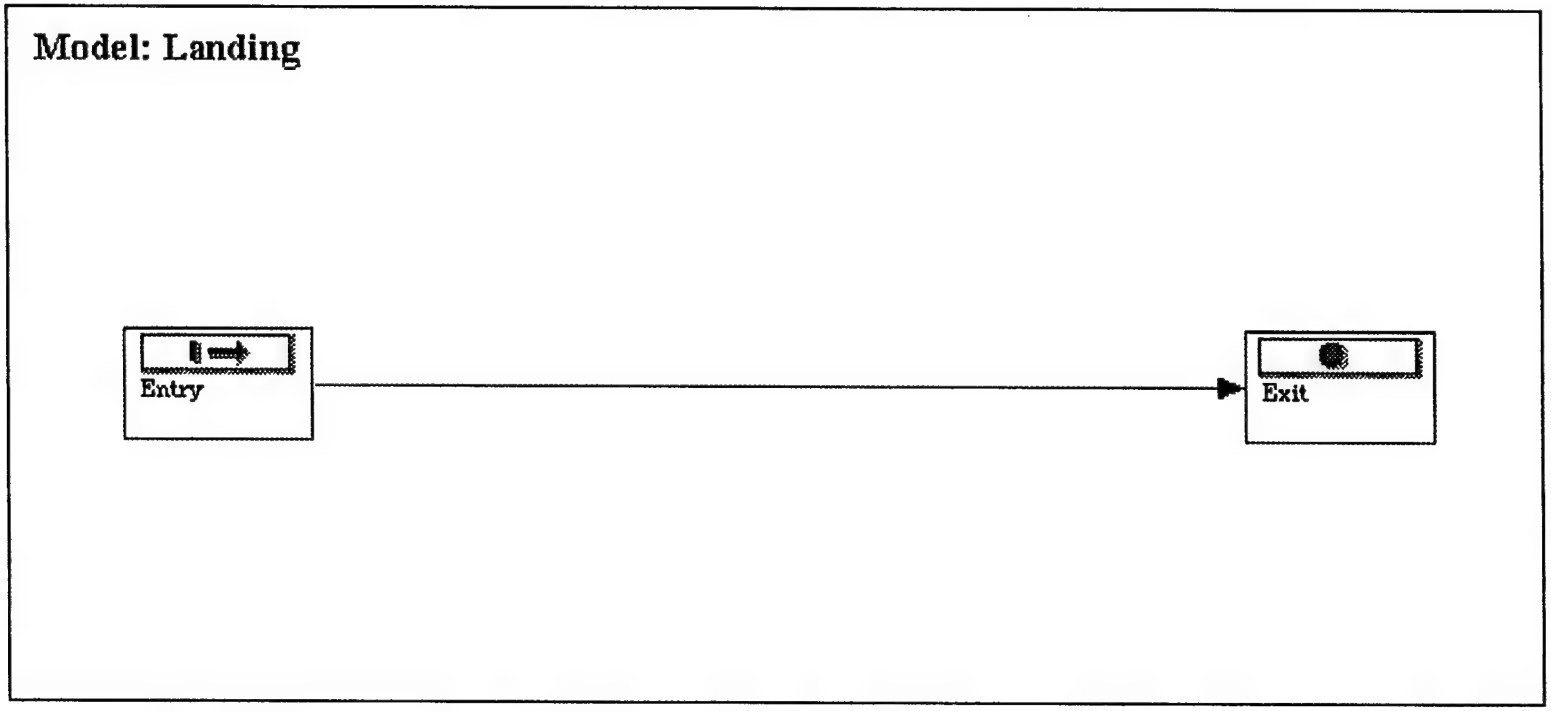

Model: Set_Mark_C
Nav_Panel
Alpha_Displa
y
Zeroes_to_Bla
nks
Entry
Exit
Save_LMD_V
alues
Save_RMD_V
alues
+T
+T
+T
+T

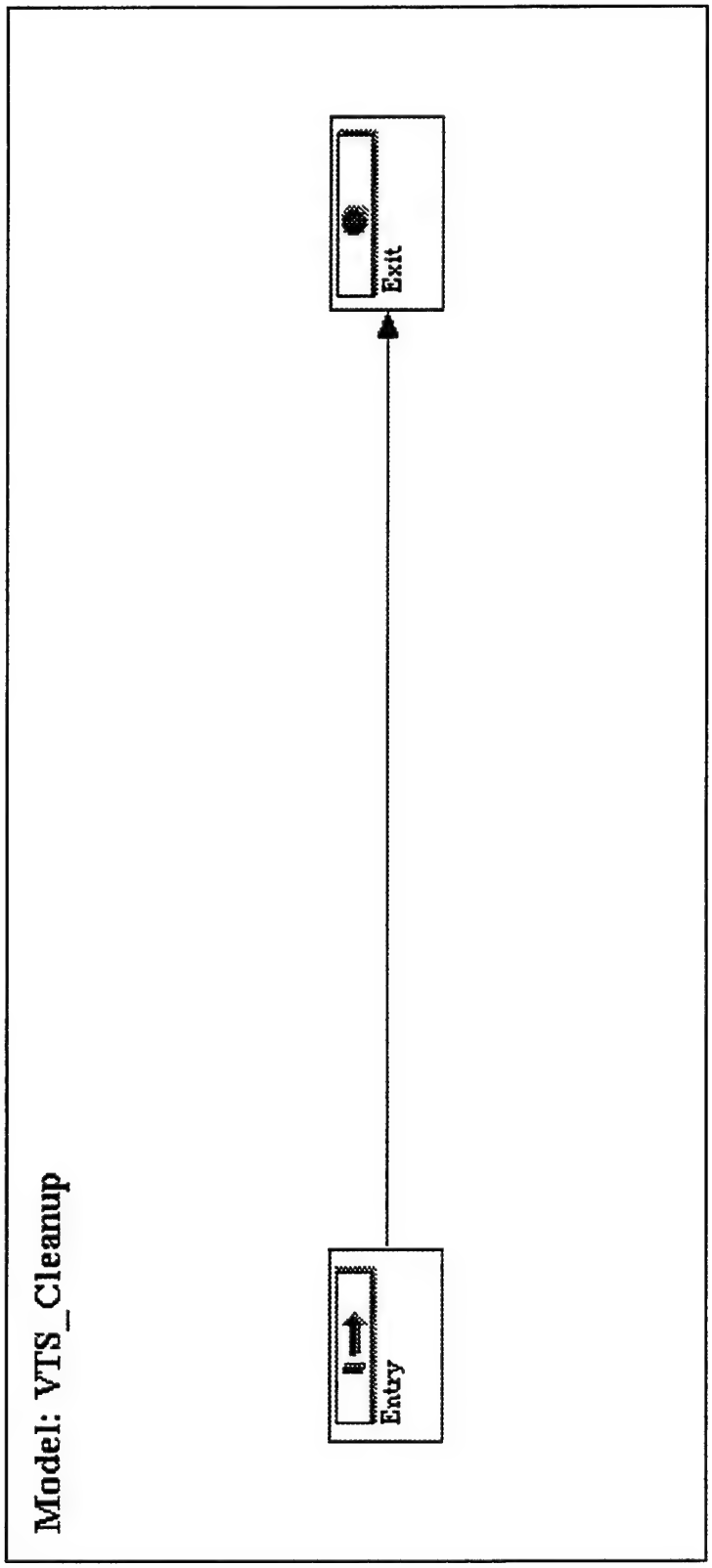

Model: Verify_Mark_Points
Verify_Mark_
A
Verify_Mark_
B
Verify_Mark_
C
*T
*T
Entry
Exit


Model: Verify_Mark_A
Nav_Panel
Verify_LMD_
Values
Verify_RMD_
Values
A: <Inv+
+T
+T
Entry
Exit


Model: Verify_Mark_B
Nav_Panel
Verify_LMD_
Value
Verify_RMD_
Value
Entry
Exit
A:<I+
+T
+T


Model: Verify_Mark_C
Nav_Panel
Verify_LMD_
Value
Verify_RMD_
Value
Entry
Exit
A:<I+
+T
+T


Model: Landing
Entry
Exit


Model: VTS_Cleanup
Entry
Exit

THIS PAGE INTENTIONALLY LEFT BLANK

Appendix D

40.0 TESTMASTER™-GENERATED AUTOVAL CODE

THIS PAGE INTENTIONALLY LEFT BLANK

```
path1() {
! Scenario Option:  Scenario_1
!
! Description:
!     This scenario enters data into each Mission Plan Type,
!     verifies the data, takes off and flies a short time,
!     and then verifies the data again.
!


       ;Load initialization files
       $ $MAC_ROOT/MAC_AVL_LOAD_COND.S TSTCAS
       set ICMode ON

       set Fcc_Pwr On

       print ""
       print "=====>> MISSION PLANNING DATA ENTRY <<====="

       set Panel HUD
       set Hud_Pwr On
       set Panel FCNP

       print ""

       print "**** Begin Offset Aimpoint 2 Data"


       print "    Offset Aimpoint 2:  0"
       turn Function_Knob NAV
       turn Data_knob DEST
       set Thumbwheel 0
       set Spare_Button Off
       set Aimpoint OAP2

       Wait /time = 1.0
       ;Put Data Opt in a known common position
       Data_Opt_To "E/N"
       set Data_Opt On

       set Data_Opt On    ;DATA OPT 2
       Enter_LMD "+   31"   ;elevation
       set Data_Opt On    ;DATA OPT 1
       Enter_LMD "+  543"   ;bearing
       Enter_RMD "+  5110"   ;range

       print "    Offset Aimpoint 2:  1"
       turn Function_Knob NAV
       turn Data_knob DEST
       set Thumbwheel 1
       set Spare_Button Off
       set Aimpoint OAP2


       set Data_Opt On    ;DATA OPT 2
       Enter_LMD "- 5612"   ;elevation
       set Data_Opt On    ;DATA OPT 1
       Enter_LMD "+ 1129"   ;bearing
       Enter_RMD "+ 71234"   ;range

       print "    Offset Aimpoint 2:  2"
       turn Function_Knob NAV
       turn Data_knob DEST
       set Thumbwheel 2
       set Spare_Button Off
       set Aimpoint OAP2


       Enter_LMD "+  327"   ;bearing
       set Data_Opt On    ;DATA OPT 2
       Enter_LMD "+  512"   ;elevation
       set Data_Opt On    ;DATA OPT 1
       Enter_RMD "+   171"   ;range

       print "**** Offset Aimpoint 2 Data Complete"
       print ""


       print "**** Begin UTM Data"


       print "    UTM Steerpoint:  F"
       turn Function_Knob NAV
       turn Data_knob DEST
       set Thumbwheel F
       set Spare_Button Off
       set Aimpoint DirAim

       Wait /time = 1.0
       ;Put Data Opt in a known common position
       Data_Opt_To "ORG"

       Enter_LMD "S63218"   ;ORG lat
       Enter_RMD "E  0333"   ;ORG long

       set Data_Opt On    ;DATA OPT 2
       Enter_RMD "+000735"   ;Grid Coord
       set Data_Opt On    ;DATA OPT 3
       ; Display Grid lat/long
       set Data_Opt On    ;DATA OPT 1
       set Data_Opt On    ;DATA OPT 2
       Enter_LMD "+80000"   ;Elevation

       print "    UTM Steerpoint:  D"
       turn Function_Knob NAV
       turn Data_knob DEST
       set Thumbwheel D
       set Spare_Button Off
       set Aimpoint DirAim


       Enter_LMD "- 1099"   ;Elevation
       Enter_RMD "+878134"   ;Grid Coord
       set Data_Opt On    ;DATA OPT 3
       ; Display Grid lat/long
       set Data_Opt On    ;DATA OPT 1
       Enter_LMD "N73157"   ;ORG lat
       Enter_RMD "W 87551"   ;ORG long

       print "    UTM Steerpoint:  E"
       turn Function_Knob NAV
       turn Data_knob DEST
       set Thumbwheel E
       set Spare_Button Off
       set Aimpoint DirAim


       set Data_Opt On    ;DATA OPT 2
       Enter_LMD "+ 1859"   ;Elevation
       Enter_RMD "+456999"   ;Grid Coord
       set Data_Opt On    ;DATA OPT 3
       ; Display Grid lat/long
       set Data_Opt On    ;DATA OPT 1
       Enter_LMD "N 7439"   ;ORG lat
       Enter_RMD "E161399"   ;ORG long
       set Data_Opt On    ;DATA OPT 2

       print "**** UTM Data Complete"
       print ""


       print "**** Begin PENGUIN Steerpoint Data"


       print "    PENGUIN Steerpoint:  A"
       turn Function_Knob NAV
       turn Data_knob DEST
       set Thumbwheel A
       set Spare_Button On
       set Aimpoint DirAim

       Wait /time = 1.0
       ;Put Data Opt in a known common position
       Data_Opt_To "L/L"

       Enter_LMD "S88522"   ;PSP lat
       set Data_Opt On    ;DATA OPT 2
       set Data_Opt On    ;DATA OPT 3
       Enter_LMD "+ 1837"   ;PSP velocity
       Enter_RMD "+  3145"   ;PSP track
       set Data_Opt On    ;DATA OPT 4
       Enter_RMD "+170845"   ;PSP TOD
       set Data_Opt On    ;DATA OPT 1
       Enter_RMD "E163351"   ;PSP long
       set Data_Opt On    ;DATA OPT 2
       Enter_RMD "+214541"   ;PSP TOT
       Enter_LMD "- 1500"   ;PSP elevation

       print "    PENGUIN Steerpoint:  B"
       turn Function_Knob NAV
       turn Data_knob DEST
       set Thumbwheel B
       set Spare_Button On
       set Aimpoint DirAim


       Enter_RMD "+180703"   ;PSP TOT
       Enter_LMD "+14667"   ;PSP elevation
       set Data_Opt On    ;DATA OPT 3
       Enter_LMD "+   15"   ;PSP velocity
       Enter_RMD "+   780"   ;PSP track
       set Data_Opt On    ;DATA OPT 4
       Enter_RMD "+124503"   ;PSP TOD
       set Data_Opt On    ;DATA OPT 1
       Enter_RMD "E 99465"   ;PSP long
       Enter_LMD "N 7472"   ;PSP lat
       set Data_Opt On    ;DATA OPT 2
       set Data_Opt On    ;DATA OPT 3
```

```
print "    PENGUIN Steerpoint:  C"
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel C
set Spare_Button On
set Aimpoint DirAim


set Data_Opt On    ;DATA OPT 4
set Data_Opt On    ;DATA OPT 1
Enter_LMD "N29114"   ;PSP lat
Enter_RMD "W108184"   ;PSP long
set Data_Opt On    ;DATA OPT 2
Enter_RMD "+032156"   ;PSP TOT
Enter_LMD "+  723"   ;PSP elevation
set Data_Opt On    ;DATA OPT 3
Enter_LMD "+  758"   ;PSP velocity
Enter_RMD "+  1277"   ;PSP track
set Data_Opt On    ;DATA OPT 4
Enter_RMD "+080307"   ;PSP TOD

print "**** PENGUIN Steerpoint Data Complete"
print ""


print "**** Begin PENGUIN Waypoint 1 Data"


print "    PENGUIN Waypoint 1:  A"
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel A
set Spare_Button On
set Aimpoint OAP1

Wait /time = 1.0
;Put Data Opt in a known common position
Data_Opt_To "WAY"

Enter_LMD "N73129"   ;PWP lat
set Data_Opt On    ;DATA OPT 2
Enter_LMD "+17356"   ;PWP elevation
set Data_Opt On    ;DATA OPT 1
Enter_RMD "W 84338"   ;PWP long
set Data_Opt On    ;DATA OPT 2
; Display PWP waypoint #

print "    PENGUIN Waypoint 1:  B"
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel B
set Spare_Button On
set Aimpoint OAP1


Enter_LMD "-  272"   ;PWP elevation
set Data_Opt On    ;DATA OPT 1
Enter_RMD "E137430"   ;PWP long
Enter_LMD "N 8531"   ;PWP lat
set Data_Opt On    ;DATA OPT 2
; Display PWP waypoint #
set Data_Opt On    ;DATA OPT 1

print "    PENGUIN Waypoint 1:  C"
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel C
set Spare_Button On
set Aimpoint OAP1


set Data_Opt On    ;DATA OPT 2
Enter_LMD "+ 7891"   ;PWP elevation
set Data_Opt On    ;DATA OPT 1
Enter_RMD "E109272"   ;PWP long
Enter_LMD "S86133"   ;PWP lat
set Data_Opt On    ;DATA OPT 2
; Display PWP waypoint #

print "**** PENGUIN Waypoint 1 Data Complete"
print ""


print "**** Begin Steerpoint Data"


print "    Steerpoint:  3"
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel 3
set Spare_Button Off
set Aimpoint DirAim

Wait /time = 1.0
;Put Data Opt in a known common position
Data_Opt_To "E/T"
set Data_Opt On

Enter_RMD "E180000"   ;stpt long
Enter_LMD "S90000"   ;stpt lat
set Data_Opt On    ;DATA OPT 2
Enter_LMD "     0"   ;stpt elevation
Enter_RMD "+120001"   ;stpt TOT

print "    Steerpoint:  4"
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel 4
set Spare_Button Off
set Aimpoint DirAim


set Data_Opt On    ;DATA OPT 1
Enter_LMD "N89599"   ;stpt lat
Enter_RMD "W  1010"   ;stpt long
set Data_Opt On    ;DATA OPT 2
Enter_LMD "+    1"   ;stpt elevation
Enter_RMD "+235858"   ;stpt TOT

print "    Steerpoint:  0"
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel 0
set Spare_Button Off
set Aimpoint DirAim


Enter_LMD "+   41"   ;stpt elevation
Enter_RMD "+102337"   ;stpt TOT
set Data_Opt On    ;DATA OPT 1
Enter_RMD "W118043"   ;stpt long
Enter_LMD "N17417"   ;stpt lat

print "    Steerpoint:  1"
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel 1
set Spare_Button Off
set Aimpoint DirAim


Enter_LMD "S45548"   ;stpt lat
Enter_RMD "E102225"   ;stpt long
set Data_Opt On    ;DATA OPT 2
Enter_LMD "+   13"   ;stpt elevation
Enter_RMD "+080706"   ;stpt TOT

print "    Steerpoint:  2"
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel 2
set Spare_Button Off
set Aimpoint DirAim


Enter_LMD "+80000"   ;stpt elevation
Enter_RMD "+235959"   ;stpt TOT
set Data_Opt On    ;DATA OPT 1
Enter_RMD "E  0000"   ;stpt long
Enter_LMD "N 0000"   ;stpt lat

print "**** Steerpoint Data Complete"
print ""


print "**** Begin Offset Aimpoint 1 Data"


print "    Offset Aimpoint 1:  4"
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel 4
set Spare_Button Off
set Aimpoint OAP1

Wait /time = 1.0
;Put Data Opt in a known common position
Data_Opt_To "E/N"
set Data_Opt On

Enter_LMD "    00"   ;bearing
Enter_RMD " 999999"   ;range
set Data_Opt On    ;DATA OPT 2
Enter_LMD "- 1500"   ;elevation
```

```
print "    Offset Aimpoint 1:  0"
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel 0
set Spare_Button Off
set Aimpoint OAP1


set Data_Opt On    ;DATA OPT 1
Enter_RMD "+  8723"   ;range
Enter_LMD "+ 1126"   ;bearing
set Data_Opt On    ;DATA OPT 2
Enter_LMD "-  333"   ;elevation

print "    Offset Aimpoint 1:  1"
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel 1
set Spare_Button Off
set Aimpoint OAP1


Enter_LMD "+ 1023"   ;elevation
set Data_Opt On    ;DATA OPT 1
Enter_LMD "+ 1015"   ;bearing
Enter_RMD "+  9913"   ;range

print "    Offset Aimpoint 1:  2"
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel 2
set Spare_Button Off
set Aimpoint OAP1


Enter_LMD "+  327"   ;bearing
Enter_RMD "+   171"   ;range
set Data_Opt On    ;DATA OPT 2
set Data_Opt On    ;DATA OPT 1
set Data_Opt On    ;DATA OPT 2
Enter_LMD "+  512"   ;elevation

print "    Offset Aimpoint 1:  3"
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel 3
set Spare_Button Off
set Aimpoint OAP1


Enter_LMD " 80000"   ;elevation
set Data_Opt On    ;DATA OPT 1
Enter_LMD "+ 3599"   ;bearing
Enter_RMD "      0"   ;range

print "**** Offset Aimpoint 1 Data Complete"
print ""



print ""
print "=====>> Mode Switching <<====="

set Data_Opt On
set Mode_Select On
turn Function_Knob HUD_FIX
turn Data_Knob MISC
set Data_Opt On
set Mode_Select On
set Mode_Select On
turn Function_Knob RDR_FIX
turn Function_Knob OFF
turn Data_knob Cruise
turn Function_Knob NAV
turn Data_knob DEST
turn Function_Knob OVERFLY
turn Data_knob BCN
turn Function_Knob CAL
turn Data_knob TEST
set Data_Opt On
set Mode_Select On
turn Function_Knob OFF
turn Data_knob Cruise
set Data_Opt On
set Mode_Select On
turn Function_Knob NAV
turn Data_knob DEST
set Data_Opt On
set Mode_Select On
set Mode_Select On
turn Function_Knob OVERFLY
turn Function_Knob AUX
turn Data_Knob SPARE
turn Function_Knob ATTD
turn Data_knob STRG

;Cycle FCC power
;set Landing_Gear Up   ;do this so the FCC comes back up faster
Toggle_On FCC_PWR 2.0
wait /time = 2.0   ;wait for power to be turned on

turn Function_Knob NAV
turn Data_knob DEST
turn Function_Knob OVERFLY
turn Data_knob BCN
set Data_Opt On
set Mode_Select On
turn Function_Knob CAL
turn Data_knob TEST
set Data_Opt On
set Mode_Select On
set Data_Opt On
set Mode_Select On
set Data_Opt On
set Mode_Select On
set Mode_Select On
turn Function_Knob NORM
turn Function_Knob SP
turn Data_knob WIND
turn Function_Knob HUD_FIX
turn Data_Knob MISC
turn Function_Knob RDR_FIX
turn Data_knob TISL
turn Function_Knob STOR_HDG
turn Data_knob ALT_CAL
turn Function_Knob SP
turn Data_knob WIND
set Data_Opt On
set Mode_Select On
turn Function_Knob HUD_FIX
turn Data_Knob MISC
set Data_Opt On
set Mode_Select On

print ""
print "=====>> Mission Planning Data Verification <<====="
print ""


print "**** Begin PENGUIN Steerpoint Data"


print "    PENGUIN Steerpoint:  A"
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel A
set Spare_Button On
set Aimpoint DirAim

Wait /time = 1.0
;Put Data Opt in a known common position
Data_Opt_To "L/L"

Verify_RMD "E163351"   ;PSP long
Verify_LMD "S88522"   ;PSP lat
set Data_Opt On    ;DATA OPT 2
set Data_Opt On    ;DATA OPT 3
Verify_LMD "+ 1837"   ;PSP velocity
Verify_RMD "+  3145"   ;PSP track
set Data_Opt On    ;DATA OPT 4
Verify_RMD "+170845"   ;PSP TOD
set Data_Opt On    ;DATA OPT 1
set Data_Opt On    ;DATA OPT 2
Verify_RMD "+214541"   ;PSP TOT
Verify_LMD "- 1500"   ;PSP elevation

print "    PENGUIN Steerpoint:  B"
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel B
set Spare_Button On
set Aimpoint DirAim


Verify_RMD "+180703"   ;PSP TOT
Verify_LMD "+14667"   ;PSP elevation
set Data_Opt On    ;DATA OPT 3
Verify_LMD "+   15"   ;PSP velocity
Verify_RMD "+   780"   ;PSP track
set Data_Opt On    ;DATA OPT 4
Verify_RMD "+124503"   ;PSP TOD
set Data_Opt On    ;DATA OPT 1
Verify_RMD "E 99465"   ;PSP long
Verify_LMD "N 7472"   ;PSP lat

print "    PENGUIN Steerpoint:  C"
```

```
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel C
set Spare_Button On
set Aimpoint DirAim


Verify_RMD "W108184"   ;PSP long
Verify_LMD "N29114"   ;PSP lat
set Data_Opt On    ;DATA OPT 2
set Data_Opt On    ;DATA OPT 3
Verify_LMD "+  758"   ;PSP velocity
Verify_RMD "+  1277"   ;PSP track
set Data_Opt On    ;DATA OPT 4
Verify_RMD "+080307"   ;PSP TOD
set Data_Opt On    ;DATA OPT 1
set Data_Opt On    ;DATA OPT 2
Verify_RMD "+032156"   ;PSP TOT
Verify_LMD "+  723"   ;PSP elevation

print "**** PENGUIN Steerpoint Data Complete"
print ""


print "**** Begin Steerpoint Data"


print "    Steerpoint:  1"
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel 1
set Spare_Button Off
set Aimpoint DirAim

Wait /time = 1.0
;Put Data Opt in a known common position
Data_Opt_To "E/T"
set Data_Opt On

Verify_LMD "S45548"   ;stpt lat
Verify_RMD "E102225"   ;stpt long
set Data_Opt On    ;DATA OPT 2
Verify_LMD "+   13"   ;stpt elevation
Verify_RMD "+080706"   ;stpt TOT

print "    Steerpoint:  2"
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel 2
set Spare_Button Off
set Aimpoint DirAim


Verify_LMD "+80000"   ;stpt elevation
Verify_RMD "+235959"   ;stpt TOT
set Data_Opt On    ;DATA OPT 1
Verify_RMD "E  0000"   ;stpt long
set Data_Opt On    ;DATA OPT 2
set Data_Opt On    ;DATA OPT 1
Verify_LMD "N 0000"   ;stpt lat

print "    Steerpoint:  3"
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel 3
set Spare_Button Off
set Aimpoint DirAim


set Data_Opt On    ;DATA OPT 2
set Data_Opt On    ;DATA OPT 1
Verify_LMD "S90000"   ;stpt lat
Verify_RMD "E180000"   ;stpt long
set Data_Opt On    ;DATA OPT 2
Verify_LMD "     0"    ;stpt elevation
Verify_RMD "+120001"   ;stpt TOT

print "    Steerpoint:  4"
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel 4
set Spare_Button Off
set Aimpoint DirAim


Verify_LMD "+    1"    ;stpt elevation
Verify_RMD "+235858"   ;stpt TOT
set Data_Opt On    ;DATA OPT 1
Verify_RMD "W  1010"   ;stpt long
set Data_Opt On    ;DATA OPT 2
set Data_Opt On    ;DATA OPT 1
Verify_LMD "N89599"   ;stpt lat

print "    Steerpoint:  0"
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel 0
set Spare_Button Off
set Aimpoint DirAim


set Data_Opt On    ;DATA OPT 2
set Data_Opt On    ;DATA OPT 1
Verify_LMD "N17417"   ;stpt lat
Verify_RMD "W118043"   ;stpt long
set Data_Opt On    ;DATA OPT 2
Verify_LMD "+   41"   ;stpt elevation
Verify_RMD "+102337"   ;stpt TOT

print "**** Steerpoint Data Complete"
print ""


print "**** Begin Offset Aimpoint 1 Data"


print "    Offset Aimpoint 1:  2"
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel 2
set Spare_Button Off
set Aimpoint OAP1

Wait /time = 1.0
;Put Data Opt in a known common position
Data_Opt_To "E/N"
set Data_Opt On

Verify_LMD "+  327"   ;bearing
Verify_RMD "+   171"   ;range
set Data_Opt On    ;DATA OPT 2
set Data_Opt On    ;DATA OPT 1
set Data_Opt On    ;DATA OPT 2
Verify_LMD "+  512"   ;elevation

print "    Offset Aimpoint 1:  3"
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel 3
set Spare_Button Off
set Aimpoint OAP1


set Data_Opt On    ;DATA OPT 1
set Data_Opt On    ;DATA OPT 2
Verify_LMD " 80000"   ;elevation
set Data_Opt On    ;DATA OPT 1
Verify_LMD "+ 3599"   ;bearing
Verify_RMD "      0"   ;range

print "    Offset Aimpoint 1:  4"
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel 4
set Spare_Button Off
set Aimpoint OAP1


Verify_RMD " 999999"   ;range
set Data_Opt On    ;DATA OPT 2
Verify_LMD "- 1500"   ;elevation
set Data_Opt On    ;DATA OPT 1
Verify_LMD "    00"   ;bearing

print "    Offset Aimpoint 1:  0"
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel 0
set Spare_Button Off
set Aimpoint OAP1


set Data_Opt On    ;DATA OPT 2
set Data_Opt On    ;DATA OPT 1
Verify_LMD "+ 1126"   ;bearing
Verify_RMD "+  8723"   ;range
set Data_Opt On    ;DATA OPT 2
Verify_LMD "-  333"   ;elevation

print "    Offset Aimpoint 1:  1"
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel 1
set Spare_Button Off
set Aimpoint OAP1
```

```
set Data_Opt On    ;DATA OPT 1
set Data_Opt On    ;DATA OPT 2
Verify_LMD "+ 1023"   ;elevation
set Data_Opt On    ;DATA OPT 1
Verify_LMD "+ 1015"   ;bearing
Verify_RMD "+  9913"   ;range

print "**** Offset Aimpoint 1 Data Complete"
print ""


print "**** Begin Offset Aimpoint 2 Data"


print "    Offset Aimpoint 2:  0"
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel 0
set Spare_Button Off
set Aimpoint OAP2

Wait /time = 1.0
;Put Data Opt in a known common position
Data_Opt_To "E/N"
set Data_Opt On

Verify_LMD "+  543"   ;bearing
Verify_RMD "+  5110"   ;range
set Data_Opt On    ;DATA OPT 2
Verify_LMD "+   31"   ;elevation

print "    Offset Aimpoint 2:  1"
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel 1
set Spare_Button Off
set Aimpoint OAP2


set Data_Opt On    ;DATA OPT 1
Verify_LMD "+ 1129"   ;bearing
Verify_RMD "+ 71234"   ;range
set Data_Opt On    ;DATA OPT 2
Verify_LMD "- 5612"   ;elevation
set Data_Opt On    ;DATA OPT 1

print "    Offset Aimpoint 2:  2"
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel 2
set Spare_Button Off
set Aimpoint OAP2


Verify_RMD "+   171"   ;range
set Data_Opt On    ;DATA OPT 2
set Data_Opt On    ;DATA OPT 1
Verify_LMD "+  327"   ;bearing
set Data_Opt On    ;DATA OPT 2
Verify_LMD "+  512"   ;elevation

print "**** Offset Aimpoint 2 Data Complete"
print ""


print "**** Begin UTM Data"


print "    UTM Steerpoint:  D"
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel D
set Spare_Button Off
set Aimpoint DirAim

Wait /time = 1.0
;Put Data Opt in a known common position
Data_Opt_To "ORG"

Verify_LMD "N73157"   ;ORG lat
Verify_RMD "W 87551"   ;ORG long
set Data_Opt On    ;DATA OPT 2
Verify_LMD "- 1099"   ;Elevation
Verify_RMD "+878134"   ;Grid Coord
set Data_Opt On    ;DATA OPT 3
Verify_LMD "N73236"   ;Grid lat
Verify_RMD "W 85104"   ;Grid long

print "    UTM Steerpoint:  E"
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel E
set Spare_Button Off
set Aimpoint DirAim


Verify_LMD "N 8383"   ;Grid lat
Verify_RMD "E162043"   ;Grid long
set Data_Opt On    ;DATA OPT 1
set Data_Opt On    ;DATA OPT 2
Verify_LMD "+ 1859"   ;Elevation
Verify_RMD "+456999"   ;Grid Coord
set Data_Opt On    ;DATA OPT 3
set Data_Opt On    ;DATA OPT 1
Verify_LMD "N 7439"   ;ORG lat
Verify_RMD "E161399"   ;ORG long

print "    UTM Steerpoint:  F"
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel F
set Spare_Button Off
set Aimpoint DirAim


Verify_LMD "S63218"   ;ORG lat
Verify_RMD "E  0333"   ;ORG long
set Data_Opt On    ;DATA OPT 2
set Data_Opt On    ;DATA OPT 3
Verify_LMD "S62423"   ;Grid lat
Verify_RMD "E  0366"   ;Grid long
set Data_Opt On    ;DATA OPT 1
set Data_Opt On    ;DATA OPT 2
Verify_LMD "+80000"   ;Elevation
Verify_RMD "+000735"   ;Grid Coord

print "**** UTM Data Complete"
print ""


print "**** Begin PENGUIN Waypoint 1 Data"


print "    PENGUIN Waypoint 1:  A"
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel A
set Spare_Button On
set Aimpoint OAP1

Wait /time = 1.0
;Put Data Opt in a known common position
Data_Opt_To "WAY"

Verify_LMD "N73129"   ;PWP lat
set Data_Opt On    ;DATA OPT 2
set Data_Opt On    ;DATA OPT 1
Verify_RMD "W 84338"   ;PWP long
set Data_Opt On    ;DATA OPT 2
Verify_LMD "+    26"   ;PWP waypoint #
Verify_LMD "+17356"   ;PWP elevation

print "    PENGUIN Waypoint 1:  B"
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel B
set Spare_Button On
set Aimpoint OAP1


Verify_LMD "-  272"   ;PWP elevation
set Data_Opt On    ;DATA OPT 1
Verify_LMD "N 8531"   ;PWP lat
set Data_Opt On    ;DATA OPT 2
Verify_LMD "+    27"   ;PWP waypoint #
set Data_Opt On    ;DATA OPT 1
Verify_RMD "E137430"   ;PWP long

print "    PENGUIN Waypoint 1:  C"
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel C
set Spare_Button On
set Aimpoint OAP1


Verify_RMD "E109272"   ;PWP long
Verify_LMD "S86133"   ;PWP lat
set Data_Opt On    ;DATA OPT 2
Verify_LMD "+ 7891"   ;PWP elevation
set Data_Opt On    ;DATA OPT 1
set Data_Opt On    ;DATA OPT 2
Verify_LMD "+    28"   ;PWP waypoint #

print "**** PENGUIN Waypoint 1 Data Complete"
```

```
print ""


print ""
print "=====>> TAKEOFF <<====="

;TakeOff Conditions Set
Airspeed 600
Climb 25
set Landing_Gear Up
Altitude 20000

print "=====>> TAKEOFF COMPLETE <<====="
print ""


print ""
print "=====>> FLIGHT <<====="

;Fly the aircraft a short time
Wait /time = 10.0


print ""
print "=====>> Mode Switching <<====="

turn Function_Knob CAL
turn Data_knob TEST
turn Function_Knob OFF
turn Data_knob Cruise
turn Function_Knob NAV
turn Data_knob DEST
turn Function_Knob OVERFLY
turn Data_knob BCN
set Data_Opt On
set Mode_Select On
turn Function_Knob CAL
turn Data_knob TEST
set Data_Opt On
set Mode_Select On
set Data_Opt On
set Mode_Select On
set Data_Opt On
set Mode_Select On
set Mode_Select On
turn Function_Knob NORM
turn Function_Knob SP
turn Data_knob WIND
turn Function_Knob HUD_FIX
turn Data_Knob MISC
turn Function_Knob RDR_FIX
turn Data_knob TISL
turn Function_Knob STOR_HDG
turn Data_knob ALT_CAL

;Cycle FCC power
;set Landing_Gear Up   ;do this so the FCC comes back up faster
Toggle_On FCC_PWR 2.0
wait /time = 2.0   ;wait for power to be turned on

turn Function_Knob TCN_FIX
turn Data_knob WPN_DEL
set Data_Opt On
set Mode_Select On
set Data_Opt On
set Mode_Select On
set Data_Opt On
set Mode_Select On
set Mode_Select On
turn Function_Knob RDR_FIX
turn Function_Knob OFF
turn Data_knob Cruise
turn Function_Knob NAV
turn Data_knob DEST
turn Function_Knob OVERFLY
turn Data_knob BCN
turn Function_Knob CAL
turn Data_knob TEST
turn Function_Knob OFF
turn Data_knob Cruise
set Data_Opt On
set Mode_Select On
turn Function_Knob NAV
turn Data_knob DEST
set Data_Opt On
set Mode_Select On
set Mode_Select On
turn Function_Knob OVERFLY
turn Function_Knob AUX
turn Data_Knob SPARE

print ""
print "=====>> Mission Planning Data Verification <<====="
print ""


print "**** Begin Steerpoint Data"


print "    Steerpoint:  1"
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel 1
set Spare_Button Off
set Aimpoint DirAim

Wait /time = 1.0
;Put Data Opt in a known common position
Data_Opt_To "E/T"
set Data_Opt On

Verify_RMD "E102225"   ;stpt long
set Data_Opt On    ;DATA OPT 2
Verify_LMD "+   13"   ;stpt elevation
Verify_RMD "+080706"   ;stpt TOT
set Data_Opt On    ;DATA OPT 1
Verify_LMD "S45548"   ;stpt lat

print "    Steerpoint:  2"
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel 2
set Spare_Button Off
set Aimpoint DirAim


set Data_Opt On    ;DATA OPT 2
set Data_Opt On    ;DATA OPT 1
Verify_LMD "N 0000"   ;stpt lat
Verify_RMD "E  0000"   ;stpt long
set Data_Opt On    ;DATA OPT 2
Verify_LMD "+80000"   ;stpt elevation
Verify_RMD "+235959"   ;stpt TOT

print "    Steerpoint:  3"
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel 3
set Spare_Button Off
set Aimpoint DirAim


Verify_LMD "     0"    ;stpt elevation
Verify_RMD "+120001"   ;stpt TOT
set Data_Opt On    ;DATA OPT 1
Verify_RMD "E180000"   ;stpt long
set Data_Opt On    ;DATA OPT 2
set Data_Opt On    ;DATA OPT 1
Verify_LMD "S90000"   ;stpt lat

print "    Steerpoint:  4"
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel 4
set Spare_Button Off
set Aimpoint DirAim


set Data_Opt On    ;DATA OPT 2
set Data_Opt On    ;DATA OPT 1
Verify_LMD "N89599"   ;stpt lat
Verify_RMD "W  1010"   ;stpt long
set Data_Opt On    ;DATA OPT 2
Verify_LMD "+    1"    ;stpt elevation
Verify_RMD "+235858"   ;stpt TOT

print "    Steerpoint:  0"
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel 0
set Spare_Button Off
set Aimpoint DirAim


Verify_LMD "+   41"   ;stpt elevation
Verify_RMD "+102337"   ;stpt TOT
set Data_Opt On    ;DATA OPT 1
Verify_RMD "W118043"   ;stpt long
set Data_Opt On    ;DATA OPT 2
set Data_Opt On    ;DATA OPT 1
Verify_LMD "N17417"   ;stpt lat

print "**** Steerpoint Data Complete"
print ""
```

```
print "**** Begin Offset Aimpoint 1 Data"


print "    Offset Aimpoint 1:  2"
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel 2
set Spare_Button Off
set Aimpoint OAP1

Wait /time = 1.0
;Put Data Opt in a known common position
Data_Opt_To "E/N"
set Data_Opt On

set Data_Opt On    ;DATA OPT 2
set Data_Opt On    ;DATA OPT 1
Verify_LMD "+  327"   ;bearing
Verify_RMD "+   171"   ;range
set Data_Opt On    ;DATA OPT 2
Verify_LMD "+  512"   ;elevation

print "    Offset Aimpoint 1:  3"
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel 3
set Spare_Button Off
set Aimpoint OAP1


Verify_LMD " 80000"   ;elevation
set Data_Opt On    ;DATA OPT 1
Verify_RMD "      0"   ;range
set Data_Opt On    ;DATA OPT 2
set Data_Opt On    ;DATA OPT 1
Verify_LMD "+ 3599"   ;bearing

print "    Offset Aimpoint 1:  4"
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel 4
set Spare_Button Off
set Aimpoint OAP1


set Data_Opt On    ;DATA OPT 2
set Data_Opt On    ;DATA OPT 1
Verify_LMD "    00"   ;bearing
Verify_RMD " 999999"   ;range
set Data_Opt On    ;DATA OPT 2
Verify_LMD "- 1500"   ;elevation

print "    Offset Aimpoint 1:  0"
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel 0
set Spare_Button Off
set Aimpoint OAP1


set Data_Opt On    ;DATA OPT 1
set Data_Opt On    ;DATA OPT 2
Verify_LMD "-  333"   ;elevation
set Data_Opt On    ;DATA OPT 1
Verify_LMD "+ 1126"   ;bearing
Verify_RMD "+  8723"   ;range

print "    Offset Aimpoint 1:  1"
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel 1
set Spare_Button Off
set Aimpoint OAP1


Verify_LMD "+ 1015"   ;bearing
Verify_RMD "+  9913"   ;range
set Data_Opt On    ;DATA OPT 2
set Data_Opt On    ;DATA OPT 1
set Data_Opt On    ;DATA OPT 2
Verify_LMD "+ 1023"   ;elevation

print "**** Offset Aimpoint 1 Data Complete"
print ""


print "**** Begin Offset Aimpoint 2 Data"


print "    Offset Aimpoint 2:  0"
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel 0
set Spare_Button Off
set Aimpoint OAP2

Wait /time = 1.0
;Put Data Opt in a known common position
Data_Opt_To "E/N"
set Data_Opt On

Verify_LMD "+  543"   ;bearing
Verify_RMD "+  5110"   ;range
set Data_Opt On    ;DATA OPT 2
set Data_Opt On    ;DATA OPT 1
set Data_Opt On    ;DATA OPT 2
Verify_LMD "+   31"   ;elevation

print "    Offset Aimpoint 2:  1"
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel 1
set Spare_Button Off
set Aimpoint OAP2


set Data_Opt On    ;DATA OPT 1
Verify_RMD "+ 71234"   ;range
set Data_Opt On    ;DATA OPT 2
Verify_LMD "- 5612"   ;elevation
set Data_Opt On    ;DATA OPT 1
Verify_LMD "+ 1129"   ;bearing

print "    Offset Aimpoint 2:  2"
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel 2
set Spare_Button Off
set Aimpoint OAP2


Verify_LMD "+  327"   ;bearing
Verify_RMD "+   171"   ;range
set Data_Opt On    ;DATA OPT 2
set Data_Opt On    ;DATA OPT 1
set Data_Opt On    ;DATA OPT 2
Verify_LMD "+  512"   ;elevation

print "**** Offset Aimpoint 2 Data Complete"
print ""


print "**** Begin UTM Data"


print "    UTM Steerpoint:  F"
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel F
set Spare_Button Off
set Aimpoint DirAim

Wait /time = 1.0
;Put Data Opt in a known common position
Data_Opt_To "ORG"

set Data_Opt On    ;DATA OPT 2
Verify_LMD "+80000"   ;Elevation
Verify_RMD "+000735"   ;Grid Coord
set Data_Opt On    ;DATA OPT 3
Verify_LMD "S62423"   ;Grid lat
Verify_RMD "E  0366"   ;Grid long
set Data_Opt On    ;DATA OPT 1
Verify_LMD "S63218"   ;ORG lat
Verify_RMD "E  0333"   ;ORG long

print "    UTM Steerpoint:  D"
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel D
set Spare_Button Off
set Aimpoint DirAim


Verify_LMD "N73157"   ;ORG lat
Verify_RMD "W 87551"   ;ORG long
set Data_Opt On    ;DATA OPT 2
set Data_Opt On    ;DATA OPT 3
Verify_LMD "N73236"   ;Grid lat
Verify_RMD "W 85104"   ;Grid long
set Data_Opt On    ;DATA OPT 1
set Data_Opt On    ;DATA OPT 2
Verify_LMD "- 1099"   ;Elevation
Verify_RMD "+878134"   ;Grid Coord

print "    UTM Steerpoint:  E"
```

```
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel E
set Spare_Button Off
set Aimpoint DirAim


Verify_LMD "+ 1859"   ;Elevation
Verify_RMD "+456999"   ;Grid Coord
set Data_Opt On    ;DATA OPT 3
set Data_Opt On    ;DATA OPT 1
Verify_LMD "N 7439"   ;ORG lat
Verify_RMD "E161399"   ;ORG long
set Data_Opt On    ;DATA OPT 2
set Data_Opt On    ;DATA OPT 3
Verify_LMD "N 8383"   ;Grid lat
Verify_RMD "E162043"   ;Grid long

print "**** UTM Data Complete"
print ""


print "**** Begin PENGUIN Steerpoint Data"


print "    PENGUIN Steerpoint:  B"
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel B
set Spare_Button On
set Aimpoint DirAim

Wait /time = 1.0
;Put Data Opt in a known common position
Data_Opt_To "L/L"

set Data_Opt On    ;DATA OPT 2
Verify_RMD "+180703"   ;PSP TOT
Verify_LMD "+14667"   ;PSP elevation
set Data_Opt On    ;DATA OPT 3
Verify_LMD "+   15"   ;PSP velocity
Verify_RMD "+   780"   ;PSP track
set Data_Opt On    ;DATA OPT 4
Verify_RMD "+124503"   ;PSP TOD
set Data_Opt On    ;DATA OPT 1
Verify_RMD "E 99465"   ;PSP long
Verify_LMD "N 7472"   ;PSP lat
set Data_Opt On    ;DATA OPT 2

print "    PENGUIN Steerpoint:  A"
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel A
set Spare_Button On
set Aimpoint DirAim


Verify_LMD "- 1500"   ;PSP elevation
set Data_Opt On    ;DATA OPT 3
set Data_Opt On    ;DATA OPT 4
Verify_RMD "+170845"   ;PSP TOD
set Data_Opt On    ;DATA OPT 1
Verify_RMD "E163351"   ;PSP long
Verify_LMD "S88522"   ;PSP lat
set Data_Opt On    ;DATA OPT 2
Verify_RMD "+214541"   ;PSP TOT
set Data_Opt On    ;DATA OPT 3
Verify_LMD "+ 1837"   ;PSP velocity
Verify_RMD "+  3145"   ;PSP track

print "    PENGUIN Steerpoint:  C"
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel C
set Spare_Button On
set Aimpoint DirAim


Verify_LMD "+  758"   ;PSP velocity
Verify_RMD "+  1277"   ;PSP track
set Data_Opt On    ;DATA OPT 4
Verify_RMD "+080307"   ;PSP TOD
set Data_Opt On    ;DATA OPT 1
Verify_RMD "W108184"   ;PSP long
Verify_LMD "N29114"   ;PSP lat
set Data_Opt On    ;DATA OPT 2
Verify_RMD "+032156"   ;PSP TOT
Verify_LMD "+  723"   ;PSP elevation

print "**** PENGUIN Steerpoint Data Complete"
print ""


print "**** Begin PENGUIN Waypoint 1 Data"


print "    PENGUIN Waypoint 1:  A"
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel A
set Spare_Button On
set Aimpoint OAP1

Wait /time = 1.0
;Put Data Opt in a known common position
Data_Opt_To "WAY"

set Data_Opt On    ;DATA OPT 2
Verify_LMD "+    26"   ;PWP waypoint #
Verify_LMD "+17356"   ;PWP elevation
set Data_Opt On    ;DATA OPT 1
Verify_RMD "W 84338"   ;PWP long
Verify_LMD "N73129"   ;PWP lat

print "    PENGUIN Waypoint 1:  B"
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel B
set Spare_Button On
set Aimpoint OAP1


set Data_Opt On    ;DATA OPT 2
set Data_Opt On    ;DATA OPT 1
Verify_RMD "E137430"   ;PWP long
Verify_LMD "N 8531"   ;PWP lat
set Data_Opt On    ;DATA OPT 2
Verify_LMD "+    27"   ;PWP waypoint #
Verify_LMD "-  272"   ;PWP elevation

print "    PENGUIN Waypoint 1:  C"
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel C
set Spare_Button On
set Aimpoint OAP1


set Data_Opt On    ;DATA OPT 1
Verify_LMD "S86133"   ;PWP lat
set Data_Opt On    ;DATA OPT 2
Verify_LMD "+    28"   ;PWP waypoint #
Verify_LMD "+ 7891"   ;PWP elevation
set Data_Opt On    ;DATA OPT 1
Verify_RMD "E109272"   ;PWP long

print "**** PENGUIN Waypoint 1 Data Complete"
print ""


print ""
print "=====>> Flight Complete <<====="

}
```

```
path1() {
! Scenario Option:  Scenario_2
!
! Description:
!     This scenario enters Mission Planning data,
!     Route Details data, and Target Geometry data.
!     The data is verified, the aircraft takes off
!     and flies a short time, and the data is
!     verified again. Mark points are also set and
!     verified.
!



      ;Load initialization files
      $ $MAC_ROOT/MAC_AVL_LOAD_COND.S TSTCAS
      set ICMode ON

      set Fcc_Pwr On

      print ""
      print "=====>> Beacon, VIP, VRP Data Entry <<====="

      print ""
      print "    Beacon Target Geometry Data"
      turn Function_Knob NAV
      turn Data_knob BCN

      Wait /time = 1.0
      ;Put Data Opt in a known common position
      Data_Opt_To "B/R"
      Enter_LMD "+ 2493"   ;Beacon bearing
      Enter_RMD "+  1578"   ;Beacon range
      set Data_Opt On
      Enter_LMD "-  868"   ;Beacon elevation
      Enter_RMD "+   167"   ;Beacon Time Delay
      Data_Opt_To "B/R"

      print ""
      print "    VIP Target Geometry Data"
      turn Function_Knob NAV
      turn Data_knob WPN_DEL

      Wait /time = 1.0
      ;Put Data Opt in a known common position
      Data_Opt_To "VIP"
      set Data_Opt On
      Enter_LMD "+ 1867"   ;VIP bearing
      Enter_RMD "+  9086"   ;VIP range
      set Data_Opt On
      Enter_LMD "+13471"   ;VIP elevation
      set Data_Opt On
      Enter_LMD "+  491"   ;VIP Delta Bomb Range X
      Enter_RMD "+   376"   ;VIP Delta Bomb Range Y

      print ""
      print "    VRP Target Geometry Data"
      turn Function_Knob NAV
      turn Data_knob WPN_DEL

      Wait /time = 1.0
      ;Put Data Opt in a known common position
      Data_Opt_To "VRP"
      set Data_Opt On
      Enter_LMD "+ 2974"   ;VRP bearing
      Enter_RMD "+  8722"   ;VRP range
      set Data_Opt On
      Enter_LMD "+ 7725"   ;VRP elevation
      Data_Opt_To "VRP"

      print ""
      print "=====>> ILS Localizer Data Entry <<====="

      print ""
      print "    ILS Localizer Data"
      turn Function_Knob NAV
      turn Data_Knob MISC
      Wait /time = 1.0
      Data_Opt_To "LOC"
      Enter_LMD "+  162"   ;ILS Localizer

      print ""
      print "=====>> Manual Ballistics Data Entry <<====="

      print ""
      print "    Manual Ballistics Data"
      turn Function_Knob NAV
      turn Data_knob WPN_DEL

      Wait /time = 1.0
      ;set Mode_Select On
      ;Put Data Opt in a known common position
      Data_Opt_To "R/T"
      Enter_LMD "+ 6334"   ;Manual Ballistics Range
      Enter_RMD "+   363"   ;Manual Ballistics Time-of-Fall
      ;set Mode_Select On

      print ""
      print "=====>> IFF Advisories Data Entry <<====="

      print ""
      print "    IFF Advisory Data"
      turn Function_Knob NAV
      turn Data_knob TISL

      Wait /time = 1.0
      ;Put Data Opt in a known common position
      ;Data_Opt_To "IFF"
      ;LMD displays time to next advisory
      Enter_RMD "+    16"   ;IFF Time Between Advisories

      print ""
      print "=====>> TACAN Data Entry <<====="

      print ""
      print "    TACAN Data"
      turn Function_Knob TCN_FIX

      Wait /time = 2.0
      ;Put Data Opt in a known common position
      ;Data_Opt_To "B/R"
      Enter_LMD "+ 3186"   ;TACAN bearing
      Enter_RMD "+   885"   ;TACAN range

      print ""
      print "=====>> OFP IDENTIFICATION <<====="

      turn Function_Knob NAV
      turn Data_Knob MISC
      Wait /time = 1.0
      ; Push Data Opt 3 times
      set Data_Opt On
      set Data_Opt On
      set Data_Opt On
      ;Alpha Display of FCC OFP
      set Data_Opt On    ;DATA OPT 4
      ;Alpha Display of AIFF OFP
      set Data_Opt On    ;DATA OPT 5

      print ""
      print "=====>> MISSION PLANNING DATA ENTRY <<====="

      set Panel HUD
      set Hud_Pwr On
      set Panel FCNP

      print ""

      print "**** Begin Steerpoint Data"


      print "    Steerpoint:  1"
      turn Function_Knob NAV
      turn Data_knob DEST
      set Thumbwheel 1
      set Spare_Button Off
      set Aimpoint DirAim

      Wait /time = 1.0
      ;Put Data Opt in a known common position
      Data_Opt_To "E/T"
      set Data_Opt On

      Enter_LMD "S45548"   ;stpt lat
      set Data_Opt On    ;DATA OPT 2
      Enter_LMD "+   13"   ;stpt elevation
      Enter_RMD "+080706"   ;stpt TOT
      set Data_Opt On    ;DATA OPT 1
      Enter_RMD "E102225"   ;stpt long

      print "    Steerpoint:  2"
      turn Function_Knob NAV
      turn Data_knob DEST
      set Thumbwheel 2
      set Spare_Button Off
      set Aimpoint DirAim


      Enter_RMD "W 43147"   ;stpt long
      Enter_LMD "N13237"   ;stpt lat
      set Data_Opt On    ;DATA OPT 2
      Enter_LMD "+  323"   ;stpt elevation
      Enter_RMD "+010410"   ;stpt TOT

      print "    Steerpoint:  3"
      turn Function_Knob NAV
      turn Data_knob DEST
```

```
set Thumbwheel 3
set Spare_Button Off
set Aimpoint DirAim


Enter_LMD "+  452"    ;stpt elevation
Enter_RMD "+023721"   ;stpt TOT
set Data_Opt On    ;DATA OPT 1
Enter_RMD "W147124"   ;stpt long
Enter_LMD "S67143"    ;stpt lat

print "    Steerpoint:  4"
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel 4
set Spare_Button Off
set Aimpoint DirAim


Enter_RMD "E 93218"   ;stpt long
Enter_LMD "N13549"    ;stpt lat
set Data_Opt On    ;DATA OPT 2
Enter_LMD "+ 2374"    ;stpt elevation
Enter_RMD "+112135"   ;stpt TOT

print "    Steerpoint:  0"
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel 0
set Spare_Button Off
set Aimpoint DirAim


Enter_LMD "+   41"    ;stpt elevation
Enter_RMD "+102337"   ;stpt TOT
set Data_Opt On    ;DATA OPT 1
Enter_RMD "W118043"   ;stpt long
Enter_LMD "N17417"    ;stpt lat

print "**** Steerpoint Data Complete"
print ""


print "**** Begin Offset Aimpoint 1 Data"


print "    Offset Aimpoint 1:  0"
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel 0
set Spare_Button Off
set Aimpoint OAP1

Wait /time = 1.0
;Put Data Opt in a known common position
Data_Opt_To "E/N"
set Data_Opt On

Enter_RMD "+  8723"   ;range
set Data_Opt On    ;DATA OPT 2
set Data_Opt On    ;DATA OPT 1
Enter_LMD "+ 1126"    ;bearing
set Data_Opt On    ;DATA OPT 2
Enter_LMD "-  333"    ;elevation

print "    Offset Aimpoint 1:  1"
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel 1
set Spare_Button Off
set Aimpoint OAP1


Enter_LMD "+ 1023"    ;elevation
set Data_Opt On    ;DATA OPT 1
Enter_LMD "+ 1015"    ;bearing
Enter_RMD "+  9913"   ;range

print "**** Offset Aimpoint 1 Data Complete"
print ""


print "**** Begin Offset Aimpoint 2 Data"


print "    Offset Aimpoint 2:  0"
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel 0
set Spare_Button Off
set Aimpoint OAP2

Wait /time = 1.0
;Put Data Opt in a known common position
Data_Opt_To "E/N"
set Data_Opt On

set Data_Opt On    ;DATA OPT 2
Enter_LMD "+   31"    ;elevation
set Data_Opt On    ;DATA OPT 1
Enter_LMD "+  543"    ;bearing
Enter_RMD "+  5110"   ;range

print "    Offset Aimpoint 2:  1"
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel 1
set Spare_Button Off
set Aimpoint OAP2


Enter_LMD "+ 1129"    ;bearing
set Data_Opt On    ;DATA OPT 2
Enter_LMD "- 5612"    ;elevation
set Data_Opt On    ;DATA OPT 1
Enter_RMD "+ 71234"   ;range

print "**** Offset Aimpoint 2 Data Complete"
print ""


print "**** Begin UTM Data"


print "    UTM Steerpoint:  D"
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel D
set Spare_Button Off
set Aimpoint DirAim

Wait /time = 1.0
;Put Data Opt in a known common position
Data_Opt_To "ORG"

set Data_Opt On    ;DATA OPT 2
Enter_LMD "- 1099"    ;Elevation
Enter_RMD "+878134"   ;Grid Coord
set Data_Opt On    ;DATA OPT 3
; Display Grid lat/long
set Data_Opt On    ;DATA OPT 1
Enter_LMD "N73157"    ;ORG lat
Enter_RMD "W 87551"   ;ORG long

print "    UTM Steerpoint:  E"
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel E
set Spare_Button Off
set Aimpoint DirAim


Enter_LMD "N 7439"    ;ORG lat
set Data_Opt On    ;DATA OPT 2
Enter_LMD "+ 1859"    ;Elevation
Enter_RMD "+456999"   ;Grid Coord
set Data_Opt On    ;DATA OPT 3
; Display Grid lat/long
set Data_Opt On    ;DATA OPT 1
Enter_RMD "E161399"   ;ORG long

print "    UTM Steerpoint:  F"
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel F
set Spare_Button Off
set Aimpoint DirAim


set Data_Opt On    ;DATA OPT 2
Enter_LMD "+80000"    ;Elevation
Enter_RMD "+000735"   ;Grid Coord
set Data_Opt On    ;DATA OPT 3
; Display Grid lat/long
set Data_Opt On    ;DATA OPT 1
Enter_LMD "S63218"    ;ORG lat
Enter_RMD "E  0333"   ;ORG long

print "**** UTM Data Complete"
print ""


print "**** Begin PENGUIN Steerpoint Data"


print "    PENGUIN Steerpoint:  A"
```

```
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel A
set Spare_Button On
set Aimpoint DirAim

Wait /time = 1.0
;Put Data Opt in a known common position
Data_Opt_To "L/L"

Enter_RMD "E163351"   ;PSP long
Enter_LMD "S88522"    ;PSP lat
set Data_Opt On     ;DATA OPT 2
Enter_LMD "- 1500"    ;PSP elevation
set Data_Opt On     ;DATA OPT 3
Enter_LMD "+ 1837"    ;PSP velocity
Enter_RMD "+  3145"   ;PSP track
set Data_Opt On     ;DATA OPT 4
Enter_RMD "+170845"   ;PSP TOD
set Data_Opt On     ;DATA OPT 1
set Data_Opt On     ;DATA OPT 2
Enter_RMD "+214541"   ;PSP TOT

print "    PENGUIN Steerpoint:  B"
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel B
set Spare_Button On
set Aimpoint DirAim


Enter_RMD "+180703"   ;PSP TOT
Enter_LMD "+14667"    ;PSP elevation
set Data_Opt On     ;DATA OPT 3
Enter_LMD "+   15"    ;PSP velocity
Enter_RMD "+   780"   ;PSP track
set Data_Opt On     ;DATA OPT 4
Enter_RMD "+124503"   ;PSP TOD
set Data_Opt On     ;DATA OPT 1
Enter_RMD "E 99465"   ;PSP long
Enter_LMD "N 7472"    ;PSP lat
set Data_Opt On     ;DATA OPT 2

print "    PENGUIN Steerpoint:  C"
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel C
set Spare_Button On
set Aimpoint DirAim


Enter_LMD "+  723"    ;PSP elevation
set Data_Opt On     ;DATA OPT 3
set Data_Opt On     ;DATA OPT 4
Enter_RMD "+080307"   ;PSP TOD
set Data_Opt On     ;DATA OPT 1
Enter_RMD "W108184"   ;PSP long
Enter_LMD "N29114"    ;PSP lat
set Data_Opt On     ;DATA OPT 2
Enter_RMD "+032156"   ;PSP TOT
set Data_Opt On     ;DATA OPT 3
Enter_LMD "+  758"    ;PSP velocity
Enter_RMD "+  1277"   ;PSP track

print "**** PENGUIN Steerpoint Data Complete"
print ""


print "**** Begin PENGUIN Waypoint 1 Data"


print "    PENGUIN Waypoint 1:  A"
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel A
set Spare_Button On
set Aimpoint OAP1

Wait /time = 1.0
;Put Data Opt in a known common position
Data_Opt_To "WAY"

Enter_LMD "N73129"    ;PWP lat
set Data_Opt On     ;DATA OPT 2
Enter_LMD "+17356"    ;PWP elevation
set Data_Opt On     ;DATA OPT 1
Enter_RMD "W 84338"   ;PWP long
set Data_Opt On     ;DATA OPT 2
; Display PWP waypoint #

print "    PENGUIN Waypoint 1:  B"
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel B
set Spare_Button On
set Aimpoint OAP1


Enter_LMD "-  272"    ;PWP elevation
set Data_Opt On     ;DATA OPT 1
Enter_RMD "E137430"   ;PWP long
Enter_LMD "N 8531"    ;PWP lat
set Data_Opt On     ;DATA OPT 2
; Display PWP waypoint #
set Data_Opt On     ;DATA OPT 1

print "    PENGUIN Waypoint 1:  C"
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel C
set Spare_Button On
set Aimpoint OAP1


set Data_Opt On     ;DATA OPT 2
Enter_LMD "+ 7891"    ;PWP elevation
set Data_Opt On     ;DATA OPT 1
Enter_RMD "E109272"   ;PWP long
Enter_LMD "S86133"    ;PWP lat
set Data_Opt On     ;DATA OPT 2
; Display PWP waypoint #

print "**** PENGUIN Waypoint 1 Data Complete"
print ""


print ""
print "=====>> Altitude Calibration Data Entry <<====="

print ""
print "    Altitude Limit Data"
turn Function_Knob NAV
turn Data_knob ALT_CAL
Wait /time = 1.0
;Put Data Opt in a known common position
Data_Opt_To "AGL"
Enter_LMD "+  291"    ;AGL Altitude Limit
set Data_Opt On
Data_Opt_To "AGL"
set Data_Opt On
Enter_LMD "+ 1063"    ;MSL Altitude Limit

print ""
print "    Automatic D-VAL Calibration (Align Elevation)"
turn Function_Knob NAV
turn Data_knob POS
Wait /time = 1.0
Data_Opt_To "E/A"
Enter_LMD "+ 2991"    ;Alignment Elevation

print ""
print "=====>> Energy Management Data Entry <<====="
print ""
print "    Fuel Bingo Data"
turn Function_Knob NAV
turn Data_knob Cruise
Wait /time = 1.0
Data_Opt_To "BGO"
Enter_LMD "+ 1173"    ;Bingo fuel


print ""
print "=====>> Mode Switching <<====="

set Data_Opt On
set Mode_Select On
set Data_Opt On
set Mode_Select On
set Mode_Select On
turn Function_Knob OVERFLY
turn Function_Knob AUX
turn Data_Knob SPARE
turn Function_Knob ATTD
turn Data_knob STRG
turn Function_Knob NORM
turn Data_knob POS
turn Function_Knob TCN_FIX
turn Data_knob WPN_DEL
set Data_Opt On
set Mode_Select On
turn Function_Knob AUX
turn Data_Knob SPARE
set Data_Opt On
set Mode_Select On
turn Function_Knob ATTD
turn Data_knob STRG
```

```
set Data_Opt On
set Mode_Select On
set Mode_Select On
turn Function_Knob NORM
turn Function_Knob SP
turn Data_knob WIND
turn Function_Knob HUD_FIX
turn Data_Knob MISC

;Cycle FCC power
;set Landing_Gear Up    ;do this so the FCC comes back up faster
Toggle_On FCC_PWR 2.0
wait /time = 2.0    ;wait for power to be turned on

turn Function_Knob ATTD
turn Data_knob STRG
turn Function_Knob NORM
turn Data_knob POS
set Data_Opt On
set Mode_Select On
turn Function_Knob TCN_FIX
turn Data_knob WPN_DEL
set Data_Opt On
set Mode_Select On
set Data_Opt On
set Mode_Select On
set Data_Opt On
set Mode_Select On
set Mode_Select On
turn Function_Knob RDR_FIX
turn Function_Knob OFF
turn Data_knob Cruise
turn Function_Knob NAV
turn Data_knob DEST
turn Function_Knob OVERFLY
turn Data_knob BCN
turn Function_Knob CAL
turn Data_knob TEST
turn Function_Knob OFF
turn Data_knob Cruise
set Data_Opt On
set Mode_Select On
turn Function_Knob NAV
turn Data_knob DEST
set Data_Opt On
set Mode_Select On

print ""
print "=====>> TACAN Data Verification <<====="
print ""

print ""
print "    TACAN Data"
turn Function_Knob TCN_FIX

Wait /time = 2.0
;Put Data Opt in a known common position
;Data_Opt_To "B/R"
Verify_RMD "+   885"    ;TACAN range
Verify_LMD "+ 3186"    ;TACAN bearing

print ""
print "=====>> Beacon, VIP, VRP Data Verification <<====="
print ""

print ""
print "    Beacon Target Geometry Data"
turn Function_Knob NAV
turn Data_knob BCN

Wait /time = 1.0
;Put Data Opt in a known common position
Data_Opt_To "B/R"
Verify_LMD "+ 2493"    ;Beacon bearing
Verify_RMD "+  1578"    ;Beacon range
set Data_Opt On
Verify_RMD "+   167"    ;Beacon Time Delay
Verify_LMD "-  868"    ;Beacon elevation

print ""
print "    VIP Target Geometry Data"
turn Function_Knob NAV
turn Data_knob WPN_DEL

Wait /time = 1.0
;Put Data Opt in a known common position
Data_Opt_To "VIP"
set Data_Opt On
Verify_LMD "+ 1867"    ;VIP bearing
Verify_RMD "+  9086"    ;VIP range
set Data_Opt On
Verify_LMD "+13471"    ;VIP elevation
set Data_Opt On
Verify_LMD "+  491"    ;VIP Delta Bomb Range X
Verify_RMD "+   376"    ;VIP Delta Bomb Range Y
Data_Opt_To "VIP"
set Data_Opt On

print ""
print "    VRP Target Geometry Data"
turn Function_Knob NAV
turn Data_knob WPN_DEL

Wait /time = 1.0
;Put Data Opt in a known common position
Data_Opt_To "VRP"
set Data_Opt On
Verify_LMD "+ 2974"    ;VRP bearing
Verify_RMD "+  8722"    ;VRP range
set Data_Opt On
Verify_LMD "+ 7725"    ;VRP elevation

print ""
print "=====>> Altitude Calibration Data Verification <<====="
print ""

print ""
print "    Altitude Limit Data"
turn Function_Knob NAV
turn Data_knob ALT_CAL
Wait /time = 1.0
;Put Data Opt in a known common position
Data_Opt_To "AGL"
Verify_LMD "+  291"    ;AGL Altitude Limit
set Data_Opt On
Data_Opt_To "AGL"
set Data_Opt On
Verify_LMD "+ 1063"    ;MSL Altitude Limit

print ""
print "    Automatic D-VAL Calibration (Align Elevation)"
turn Function_Knob NAV
turn Data_knob POS
Wait /time = 1.0
Data_Opt_To "E/A"
Verify_LMD "+ 2991"    ;Alignment Elevation

print ""
print "=====>> IFF Advisories Data Verification <<====="
print ""

print ""
print "    IFF Advisory Data"
turn Function_Knob NAV
turn Data_knob TISL

Wait /time = 1.0
;Put Data Opt in a known common position
;Data_Opt_To "IFF"
Verify_RMD "+    16"    ;IFF Time Between Advisories
;LMD displays time to next advisory

print ""
print "=====>> Manual Ballistics Data Verification <<====="
print ""

print ""
print "    Manual Ballistics Data"
turn Function_Knob NAV
turn Data_knob WPN_DEL

Wait /time = 1.0
;set Mode_Select On
;Put Data Opt in a known common position
Data_Opt_To "R/T"
Verify_LMD "+ 6334"    ;Manual Ballistics Range
Verify_RMD "+   363"    ;Manual Ballistics Time-of-Fall
;set Mode_Select On

print ""
print "=====>> Mission Planning Data Verification <<====="
print ""


print "**** Begin Offset Aimpoint 1 Data"


print "    Offset Aimpoint 1:  0"
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel 0
set Spare_Button Off
set Aimpoint OAP1

Wait /time = 1.0
;Put Data Opt in a known common position
```

```
Data_Opt_To "E/N"
set Data_Opt On

Verify_RMD "+  8723"   ;range
Verify_LMD "+ 1126"   ;bearing
set Data_Opt On    ;DATA OPT 2
Verify_LMD "-  333"   ;elevation

print "    Offset Aimpoint 1:  1"
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel 1
set Spare_Button Off
set Aimpoint OAP1


set Data_Opt On    ;DATA OPT 1
set Data_Opt On    ;DATA OPT 2
Verify_LMD "+ 1023"   ;elevation
set Data_Opt On    ;DATA OPT 1
Verify_LMD "+ 1015"   ;bearing
Verify_RMD "+  9913"   ;range

print "**** Offset Aimpoint 1 Data Complete"
print ""


print "**** Begin Steerpoint Data"


print "    Steerpoint:  0"
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel 0
set Spare_Button Off
set Aimpoint DirAim

Wait /time = 1.0
;Put Data Opt in a known common position
Data_Opt_To "E/T"
set Data_Opt On

Verify_LMD "N17417"   ;stpt lat
Verify_RMD "W118043"   ;stpt long
set Data_Opt On    ;DATA OPT 2
Verify_LMD "+   41"   ;stpt elevation
Verify_RMD "+102337"   ;stpt TOT

print "    Steerpoint:  1"
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel 1
set Spare_Button Off
set Aimpoint DirAim


Verify_LMD "+   13"   ;stpt elevation
Verify_RMD "+080706"   ;stpt TOT
set Data_Opt On    ;DATA OPT 1
Verify_LMD "S45548"   ;stpt lat
Verify_RMD "E102225"   ;stpt long

print "    Steerpoint:  2"
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel 2
set Spare_Button Off
set Aimpoint DirAim


set Data_Opt On    ;DATA OPT 2
set Data_Opt On    ;DATA OPT 1
Verify_LMD "N13237"   ;stpt lat
Verify_RMD "W 43147"   ;stpt long
set Data_Opt On    ;DATA OPT 2
Verify_LMD "+  323"   ;stpt elevation
Verify_RMD "+010410"   ;stpt TOT

print "    Steerpoint:  3"
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel 3
set Spare_Button Off
set Aimpoint DirAim


Verify_LMD "+  452"    ;stpt elevation
Verify_RMD "+023721"   ;stpt TOT
set Data_Opt On    ;DATA OPT 1
Verify_LMD "S67143"   ;stpt lat
Verify_RMD "W147124"   ;stpt long

print "    Steerpoint:  4"
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel 4
set Spare_Button Off
set Aimpoint DirAim


set Data_Opt On    ;DATA OPT 2
set Data_Opt On    ;DATA OPT 1
Verify_LMD "N13549"   ;stpt lat
Verify_RMD "E 93218"   ;stpt long
set Data_Opt On    ;DATA OPT 2
Verify_LMD "+ 2374"    ;stpt elevation
Verify_RMD "+112135"   ;stpt TOT

print "**** Steerpoint Data Complete"
print ""


print "**** Begin Offset Aimpoint 2 Data"


print "    Offset Aimpoint 2:  1"
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel 1
set Spare_Button Off
set Aimpoint OAP2

Wait /time = 1.0
;Put Data Opt in a known common position
Data_Opt_To "E/N"
set Data_Opt On

Verify_LMD "+ 1129"   ;bearing
Verify_RMD "+ 71234"   ;range
set Data_Opt On    ;DATA OPT 2
Verify_LMD "- 5612"   ;elevation

print "    Offset Aimpoint 2:  0"
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel 0
set Spare_Button Off
set Aimpoint OAP2


set Data_Opt On    ;DATA OPT 1
Verify_RMD "+  5110"   ;range
set Data_Opt On    ;DATA OPT 2
Verify_LMD "+   31"   ;elevation
set Data_Opt On    ;DATA OPT 1
Verify_LMD "+  543"   ;bearing

print "**** Offset Aimpoint 2 Data Complete"
print ""


print "**** Begin UTM Data"


print "    UTM Steerpoint:  F"
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel F
set Spare_Button Off
set Aimpoint DirAim

Wait /time = 1.0
;Put Data Opt in a known common position
Data_Opt_To "ORG"

Verify_LMD "S63218"   ;ORG lat
Verify_RMD "E  0333"   ;ORG long
set Data_Opt On    ;DATA OPT 2
Verify_LMD "+80000"   ;Elevation
Verify_RMD "+000735"   ;Grid Coord
set Data_Opt On    ;DATA OPT 3
Verify_LMD "S62423"   ;Grid lat
Verify_RMD "E  0366"   ;Grid long

print "    UTM Steerpoint:  D"
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel D
set Spare_Button Off
set Aimpoint DirAim


set Data_Opt On    ;DATA OPT 1
Verify_LMD "N73157"   ;ORG lat
Verify_RMD "W 87551"   ;ORG long
set Data_Opt On    ;DATA OPT 2
```

```
Verify_LMD "- 1099"   ;Elevation
Verify_RMD "+878134"   ;Grid Coord
set Data_Opt On    ;DATA OPT 3
Verify_LMD "N73236"   ;Grid lat
Verify_RMD "W 85104"   ;Grid long
set Data_Opt On    ;DATA OPT 1

print "    UTM Steerpoint:  E"
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel E
set Spare_Button Off
set Aimpoint DirAim


set Data_Opt On    ;DATA OPT 2
Verify_RMD "+456999"   ;Grid Coord
set Data_Opt On    ;DATA OPT 3
Verify_LMD "N 8383"   ;Grid lat
Verify_RMD "E162043"   ;Grid long
set Data_Opt On    ;DATA OPT 1
Verify_LMD "N 7439"   ;ORG lat
Verify_RMD "E161399"   ;ORG long
set Data_Opt On    ;DATA OPT 2
Verify_LMD "+ 1859"   ;Elevation

print "**** UTM Data Complete"
print ""


print "**** Begin PENGUIN Steerpoint Data"


print "    PENGUIN Steerpoint:  A"
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel A
set Spare_Button On
set Aimpoint DirAim

Wait /time = 1.0
;Put Data Opt in a known common position
Data_Opt_To "L/L"

Verify_RMD "E163351"   ;PSP long
Verify_LMD "S88522"   ;PSP lat
set Data_Opt On    ;DATA OPT 2
Verify_LMD "- 1500"   ;PSP elevation
set Data_Opt On    ;DATA OPT 3
Verify_RMD "+  3145"   ;PSP track
Verify_LMD "+ 1837"   ;PSP velocity
set Data_Opt On    ;DATA OPT 4
Verify_RMD "+170845"   ;PSP TOD
set Data_Opt On    ;DATA OPT 1
set Data_Opt On    ;DATA OPT 2
Verify_RMD "+214541"   ;PSP TOT

print "    PENGUIN Steerpoint:  B"
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel B
set Spare_Button On
set Aimpoint DirAim


Verify_RMD "+180703"   ;PSP TOT
Verify_LMD "+14667"   ;PSP elevation
set Data_Opt On    ;DATA OPT 3
set Data_Opt On    ;DATA OPT 4
Verify_RMD "+124503"   ;PSP TOD
set Data_Opt On    ;DATA OPT 1
Verify_RMD "E 99465"   ;PSP long
Verify_LMD "N 7472"   ;PSP lat
set Data_Opt On    ;DATA OPT 2
set Data_Opt On    ;DATA OPT 3
Verify_LMD "+   15"   ;PSP velocity
Verify_RMD "+   780"   ;PSP track

print "    PENGUIN Steerpoint:  C"
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel C
set Spare_Button On
set Aimpoint DirAim


Verify_RMD "+  1277"   ;PSP track
set Data_Opt On    ;DATA OPT 4
Verify_RMD "+080307"   ;PSP TOD
set Data_Opt On    ;DATA OPT 1
Verify_RMD "W108184"   ;PSP long
Verify_LMD "N29114"   ;PSP lat
set Data_Opt On    ;DATA OPT 2
Verify_LMD "+  723"   ;PSP elevation
Verify_RMD "+032156"   ;PSP TOT
set Data_Opt On    ;DATA OPT 3
Verify_LMD "+  758"   ;PSP velocity
set Data_Opt On    ;DATA OPT 4

print "**** PENGUIN Steerpoint Data Complete"
print ""


print "**** Begin PENGUIN Waypoint 1 Data"


print "    PENGUIN Waypoint 1:  A"
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel A
set Spare_Button On
set Aimpoint OAP1

Wait /time = 1.0
;Put Data Opt in a known common position
Data_Opt_To "WAY"

set Data_Opt On    ;DATA OPT 2
set Data_Opt On    ;DATA OPT 1
Verify_RMD "W 84338"   ;PWP long
Verify_LMD "N73129"   ;PWP lat
set Data_Opt On    ;DATA OPT 2
Verify_LMD "+    26"   ;PWP waypoint #
Verify_LMD "+17356"   ;PWP elevation

print "    PENGUIN Waypoint 1:  B"
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel B
set Spare_Button On
set Aimpoint OAP1


set Data_Opt On    ;DATA OPT 1
Verify_LMD "N 8531"   ;PWP lat
set Data_Opt On    ;DATA OPT 2
Verify_LMD "+    27"   ;PWP waypoint #
Verify_LMD "-  272"   ;PWP elevation
set Data_Opt On    ;DATA OPT 1
Verify_RMD "E137430"   ;PWP long

print "    PENGUIN Waypoint 1:  C"
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel C
set Spare_Button On
set Aimpoint OAP1


Verify_LMD "S86133"   ;PWP lat
set Data_Opt On    ;DATA OPT 2
Verify_LMD "+ 7891"   ;PWP elevation
set Data_Opt On    ;DATA OPT 1
Verify_RMD "E109272"   ;PWP long
set Data_Opt On    ;DATA OPT 2
Verify_LMD "+    28"   ;PWP waypoint #

print "**** PENGUIN Waypoint 1 Data Complete"
print ""


print ""
print "=====>> Energy Management Data Verification <<====="
print ""
print ""
print "    Fuel Bingo Data"
turn Function_Knob NAV
turn Data_knob Cruise
Wait /time = 1.0
Data_Opt_To "BGO"
Verify_LMD "+ 1173"   ;Bingo fuel

print ""
print "=====>> ILS Localizer Data Verification <<====="
print ""

print ""
print "    ILS Localizer Data"
turn Function_Knob NAV
turn Data_Knob MISC
Wait /time = 1.0
Data_Opt_To "LOC"
Verify_LMD "+  162"   ;ILS Localizer

print ""
print "=====>> TAKEOFF <<====="
```

```
;TakeOff Conditions Set
Airspeed 600
Climb 25
set Landing_Gear Up
Altitude 20000

print "=====>> TAKEOFF COMPLETE <<====="
print ""


print ""
print "=====>> FLIGHT <<====="

;Fly the aircraft a short time
Wait /time = 10.0


print ""
print "=====>> Mode Switching <<====="

set Mode_Select On
turn Function_Knob ATTD
turn Function_Knob STOR_HDG
turn Data_knob ALT_CAL
turn Function_Knob SP
turn Data_knob WIND
turn Function_Knob HUD_FIX
turn Data_Knob MISC
turn Function_Knob RDR_FIX
turn Data_knob TISL
set Data_Opt On
set Mode_Select On
turn Function_Knob STOR_HDG
turn Data_knob ALT_CAL
set Data_Opt On
set Mode_Select On
set Data_Opt On
set Mode_Select On
set Data_Opt On
set Mode_Select On
set Mode_Select On
turn Function_Knob OVERFLY
turn Function_Knob AUX
turn Data_Knob SPARE
turn Function_Knob ATTD
turn Data_knob STRG
turn Function_Knob NORM
turn Data_knob POS

;Cycle FCC power
;set Landing_Gear Up   ;do this so the FCC comes back up faster
Toggle_On FCC_PWR 2.0
wait /time = 2.0   ;wait for power to be turned on

turn Function_Knob OVERFLY
turn Data_knob BCN
set Data_Opt On
set Mode_Select On
turn Function_Knob CAL
turn Data_knob TEST
set Data_Opt On
set Mode_Select On
set Data_Opt On
set Mode_Select On
set Data_Opt On
set Mode_Select On
set Mode_Select On
turn Function_Knob NORM
turn Function_Knob SP
turn Data_knob WIND
turn Function_Knob HUD_FIX
turn Data_Knob MISC
turn Function_Knob RDR_FIX
turn Data_knob TISL
turn Function_Knob STOR_HDG
turn Data_knob ALT_CAL
turn Function_Knob SP
turn Data_knob WIND
set Data_Opt On
set Mode_Select On
turn Function_Knob HUD_FIX
turn Data_Knob MISC
set Data_Opt On
set Mode_Select On
set Mode_Select On
turn Function_Knob RDR_FIX

print ""
print "=====>> Mission Planning Data Verification <<====="
print ""

print "**** Begin Offset Aimpoint 1 Data"


print "    Offset Aimpoint 1:  0"
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel 0
set Spare_Button Off
set Aimpoint OAP1

Wait /time = 1.0
;Put Data Opt in a known common position
Data_Opt_To "E/N"
set Data_Opt On

Verify_RMD "+  8723"   ;range
set Data_Opt On    ;DATA OPT 2
Verify_LMD "-  333"   ;elevation
set Data_Opt On    ;DATA OPT 1
Verify_LMD "+ 1126"   ;bearing

print "    Offset Aimpoint 1:  1"
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel 1
set Spare_Button Off
set Aimpoint OAP1


set Data_Opt On    ;DATA OPT 2
set Data_Opt On    ;DATA OPT 1
Verify_LMD "+ 1015"   ;bearing
Verify_RMD "+  9913"   ;range
set Data_Opt On    ;DATA OPT 2
Verify_LMD "+ 1023"   ;elevation

print "**** Offset Aimpoint 1 Data Complete"
print ""


print "**** Begin Steerpoint Data"


print "    Steerpoint:  3"
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel 3
set Spare_Button Off
set Aimpoint DirAim

Wait /time = 1.0
;Put Data Opt in a known common position
Data_Opt_To "E/T"
set Data_Opt On

set Data_Opt On    ;DATA OPT 2
Verify_RMD "+023721"   ;stpt TOT
set Data_Opt On    ;DATA OPT 1
Verify_LMD "S67143"   ;stpt lat
Verify_RMD "W147124"   ;stpt long
set Data_Opt On    ;DATA OPT 2
Verify_LMD "+  452"    ;stpt elevation

print "    Steerpoint:  4"
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel 4
set Spare_Button Off
set Aimpoint DirAim


set Data_Opt On    ;DATA OPT 1
set Data_Opt On    ;DATA OPT 2
Verify_LMD "+ 2374"    ;stpt elevation
Verify_RMD "+112135"   ;stpt TOT
set Data_Opt On    ;DATA OPT 1
Verify_LMD "N13549"   ;stpt lat
Verify_RMD "E 93218"   ;stpt long

print "    Steerpoint:  0"
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel 0
set Spare_Button Off
set Aimpoint DirAim


set Data_Opt On    ;DATA OPT 2
Verify_RMD "+102337"   ;stpt TOT
set Data_Opt On    ;DATA OPT 1
Verify_LMD "N17417"   ;stpt lat
Verify_RMD "W118043"   ;stpt long
set Data_Opt On    ;DATA OPT 2
```

```
Verify_LMD "+   41"   ;stpt elevation

print "    Steerpoint:  1"
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel 1
set Spare_Button Off
set Aimpoint DirAim


set Data_Opt On    ;DATA OPT 1
set Data_Opt On    ;DATA OPT 2
Verify_LMD "+   13"   ;stpt elevation
Verify_RMD "+080706"   ;stpt TOT
set Data_Opt On    ;DATA OPT 1
Verify_LMD "S45548"   ;stpt lat
Verify_RMD "E102225"   ;stpt long

print "    Steerpoint:  2"
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel 2
set Spare_Button Off
set Aimpoint DirAim


set Data_Opt On    ;DATA OPT 2
Verify_RMD "+010410"   ;stpt TOT
set Data_Opt On    ;DATA OPT 1
Verify_LMD "N13237"   ;stpt lat
Verify_RMD "W 43147"   ;stpt long
set Data_Opt On    ;DATA OPT 2
Verify_LMD "+  323"   ;stpt elevation

print "**** Steerpoint Data Complete"
print ""


print "**** Begin Offset Aimpoint 2 Data"


print "    Offset Aimpoint 2:  0"
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel 0
set Spare_Button Off
set Aimpoint OAP2

Wait /time = 1.0
;Put Data Opt in a known common position
Data_Opt_To "E/N"
set Data_Opt On

set Data_Opt On    ;DATA OPT 2
set Data_Opt On    ;DATA OPT 1
Verify_LMD "+  543"   ;bearing
Verify_RMD "+  5110"   ;range
set Data_Opt On    ;DATA OPT 2
Verify_LMD "+   31"   ;elevation

print "    Offset Aimpoint 2:  1"
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel 1
set Spare_Button Off
set Aimpoint OAP2


Verify_LMD "- 5612"   ;elevation
set Data_Opt On    ;DATA OPT 1
Verify_RMD "+ 71234"   ;range
set Data_Opt On    ;DATA OPT 2
set Data_Opt On    ;DATA OPT 1
Verify_LMD "+ 1129"   ;bearing

print "**** Offset Aimpoint 2 Data Complete"
print ""


print "**** Begin UTM Data"


print "    UTM Steerpoint:  D"
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel D
set Spare_Button Off
set Aimpoint DirAim

Wait /time = 1.0
;Put Data Opt in a known common position
Data_Opt_To "ORG"

Verify_LMD "N73157"   ;ORG lat
Verify_RMD "W 87551"   ;ORG long
set Data_Opt On    ;DATA OPT 2
Verify_LMD "- 1099"   ;Elevation
Verify_RMD "+878134"   ;Grid Coord
set Data_Opt On    ;DATA OPT 3
Verify_LMD "N73236"   ;Grid lat
Verify_RMD "W 85104"   ;Grid long

print "    UTM Steerpoint:  E"
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel E
set Spare_Button Off
set Aimpoint DirAim


set Data_Opt On    ;DATA OPT 1
set Data_Opt On    ;DATA OPT 2
Verify_LMD "+ 1859"   ;Elevation
Verify_RMD "+456999"   ;Grid Coord
set Data_Opt On    ;DATA OPT 3
Verify_LMD "N 8383"   ;Grid lat
Verify_RMD "E162043"   ;Grid long
set Data_Opt On    ;DATA OPT 1
Verify_LMD "N 7439"   ;ORG lat
Verify_RMD "E161399"   ;ORG long

print "    UTM Steerpoint:  F"
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel F
set Spare_Button Off
set Aimpoint DirAim


Verify_LMD "S63218"   ;ORG lat
Verify_RMD "E  0333"   ;ORG long
set Data_Opt On    ;DATA OPT 2
set Data_Opt On    ;DATA OPT 3
Verify_LMD "S62423"   ;Grid lat
Verify_RMD "E  0366"   ;Grid long
set Data_Opt On    ;DATA OPT 1
set Data_Opt On    ;DATA OPT 2
Verify_LMD "+80000"   ;Elevation
Verify_RMD "+000735"   ;Grid Coord

print "**** UTM Data Complete"
print ""


print "**** Begin PENGUIN Steerpoint Data"


print "    PENGUIN Steerpoint:  A"
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel A
set Spare_Button On
set Aimpoint DirAim

Wait /time = 1.0
;Put Data Opt in a known common position
Data_Opt_To "L/L"

Verify_RMD "E163351"   ;PSP long
Verify_LMD "S88522"   ;PSP lat
set Data_Opt On    ;DATA OPT 2
Verify_RMD "+214541"   ;PSP TOT
Verify_LMD "- 1500"   ;PSP elevation
set Data_Opt On    ;DATA OPT 3
Verify_LMD "+ 1837"   ;PSP velocity
Verify_RMD "+  3145"   ;PSP track
set Data_Opt On    ;DATA OPT 4
Verify_RMD "+170845"   ;PSP TOD

print "    PENGUIN Steerpoint:  B"
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel B
set Spare_Button On
set Aimpoint DirAim


set Data_Opt On    ;DATA OPT 1
Verify_RMD "E 99465"   ;PSP long
Verify_LMD "N 7472"   ;PSP lat
set Data_Opt On    ;DATA OPT 2
Verify_RMD "+180703"   ;PSP TOT
Verify_LMD "+14667"   ;PSP elevation
set Data_Opt On    ;DATA OPT 3
Verify_LMD "+   15"   ;PSP velocity
Verify_RMD "+   780"   ;PSP track
```

```
set Data_Opt On    ;DATA OPT 4
Verify_RMD "+124503"   ;PSP TOD
set Data_Opt On    ;DATA OPT 1

print "    PENGUIN Steerpoint:  C"
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel C
set Spare_Button On
set Aimpoint DirAim


Verify_RMD "W108184"   ;PSP long
Verify_LMD "N29114"   ;PSP lat
set Data_Opt On    ;DATA OPT 2
Verify_RMD "+032156"   ;PSP TOT
Verify_LMD "+  723"   ;PSP elevation
set Data_Opt On    ;DATA OPT 3
Verify_LMD "+  758"   ;PSP velocity
Verify_RMD "+  1277"   ;PSP track
set Data_Opt On    ;DATA OPT 4
Verify_RMD "+080307"   ;PSP TOD

print "**** PENGUIN Steerpoint Data Complete"
print ""


print "**** Begin PENGUIN Waypoint 1 Data"


print "    PENGUIN Waypoint 1:  A"
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel A
set Spare_Button On
set Aimpoint OAP1

Wait /time = 1.0
;Put Data Opt in a known common position
Data_Opt_To "WAY"

set Data_Opt On    ;DATA OPT 2
set Data_Opt On    ;DATA OPT 1
Verify_RMD "W 84338"   ;PWP long
Verify_LMD "N73129"   ;PWP lat
set Data_Opt On    ;DATA OPT 2
Verify_LMD "+    26"   ;PWP waypoint #
Verify_LMD "+17356"   ;PWP elevation

print "    PENGUIN Waypoint 1:  B"
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel B
set Spare_Button On
set Aimpoint OAP1


set Data_Opt On    ;DATA OPT 1
Verify_LMD "N 8531"   ;PWP lat
set Data_Opt On    ;DATA OPT 2
Verify_LMD "+    27"   ;PWP waypoint #
Verify_LMD "-  272"   ;PWP elevation
set Data_Opt On    ;DATA OPT 1
Verify_RMD "E137430"   ;PWP long

print "    PENGUIN Waypoint 1:  C"
turn Function_Knob NAV
turn Data_knob DEST
set Thumbwheel C
set Spare_Button On
set Aimpoint OAP1


Verify_LMD "S86133"   ;PWP lat
set Data_Opt On    ;DATA OPT 2
Verify_LMD "+ 7891"   ;PWP elevation
set Data_Opt On    ;DATA OPT 1
Verify_RMD "E109272"   ;PWP long
set Data_Opt On    ;DATA OPT 2
Verify_LMD "+    28"   ;PWP waypoint #

print "**** PENGUIN Waypoint 1 Data Complete"
print ""


print ""
print "=====>> Energy Management Data Verification <<====="
print ""
print ""
print "    Fuel Bingo Data"
turn Function_Knob NAV
turn Data_knob Cruise
Wait /time = 1.0
Data_Opt_To "BGO"
Verify_LMD "+ 1173"   ;Bingo fuel

print ""
print "=====>> ILS Localizer Data Verification <<====="
print ""

print ""
print "    ILS Localizer Data"
turn Function_Knob NAV
turn Data_Knob MISC
Wait /time = 1.0
Data_Opt_To "LOC"
Verify_LMD "+  162"   ;ILS Localizer

print ""
print "=====>> TACAN Data Verification <<====="
print ""

print ""
print "    TACAN Data"
turn Function_Knob TCN_FIX

Wait /time = 2.0
;Put Data Opt in a known common position
;Data_Opt_To "B/R"
Verify_LMD "+ 3186"   ;TACAN bearing
Verify_RMD "+   885"   ;TACAN range

print ""
print "=====>> Beacon, VIP, VRP Data Verification <<====="
print ""

print ""
print "    VIP Target Geometry Data"
turn Function_Knob NAV
turn Data_knob WPN_DEL

Wait /time = 1.0
;Put Data Opt in a known common position
Data_Opt_To "VIP"
set Data_Opt On
set Data_Opt On
Verify_LMD "+13471"   ;VIP elevation
set Data_Opt On
Verify_LMD "+  491"   ;VIP Delta Bomb Range X
Verify_RMD "+   376"   ;VIP Delta Bomb Range Y
Data_Opt_To "VIP"
set Data_Opt On
Verify_LMD "+ 1867"   ;VIP bearing
Verify_RMD "+  9086"   ;VIP range

print ""
print "    VRP Target Geometry Data"
turn Function_Knob NAV
turn Data_knob WPN_DEL

Wait /time = 1.0
;Put Data Opt in a known common position
Data_Opt_To "VRP"
set Data_Opt On
set Data_Opt On
Verify_LMD "+ 7725"   ;VRP elevation
Data_Opt_To "VRP"
set Data_Opt On
Verify_LMD "+ 2974"   ;VRP bearing
Verify_RMD "+  8722"   ;VRP range

print ""
print "    Beacon Target Geometry Data"
turn Function_Knob NAV
turn Data_knob BCN

Wait /time = 1.0
;Put Data Opt in a known common position
Data_Opt_To "B/R"
set Data_Opt On
Data_Opt_To "B/R"
Verify_LMD "+ 2493"   ;Beacon bearing
Verify_RMD "+  1578"   ;Beacon range
set Data_Opt On
Verify_LMD "-  868"   ;Beacon elevation
Verify_RMD "+   167"   ;Beacon Time Delay

print ""
print "=====>> Altitude Calibration Data Verification <<====="
print ""

print ""
print "    Altitude Limit Data"
turn Function_Knob NAV
turn Data_knob ALT_CAL
Wait /time = 1.0
```

```
        ;Put Data Opt in a known common position
        Data_Opt_To "AGL"
        Verify_LMD "+  291"   ;AGL Altitude Limit
        set Data_Opt On
        Verify_LMD "+ 1063"   ;MSL Altitude Limit
        Data_Opt_To "AGL"

        print ""
        print "    Automatic D-VAL Calibration (Align Elevation)"
        turn Function_Knob NAV
        turn Data_knob POS
        Wait /time = 1.0
        Data_Opt_To "E/A"
        Verify_LMD "+ 2991"   ;Alignment Elevation

        print ""
        print "====>> IFF Advisories Data Verification <<===="
        print ""

        print ""
        print "    IFF Advisory Data"
        turn Function_Knob NAV
        turn Data_knob TISL

        Wait /time = 1.0
        ;Put Data Opt in a known common position
        ;Data_Opt_To "IFF"
        ;LMD displays time to next advisory
        Verify_RMD "+    16"   ;IFF Time Between Advisories

        print ""
        print "====>> Manual Ballistics Data Verification <<===="
        print ""

        print ""
        print "    Manual Ballistics Data"
        turn Function_Knob NAV
        turn Data_knob WPN_DEL

        Wait /time = 1.0
        ;set Mode_Select On
        ;Put Data Opt in a known common position
        Data_Opt_To "R/T"
        Verify_LMD "+ 6334"   ;Manual Ballistics Range
        Verify_RMD "+   363"   ;Manual Ballistics Time-of-Fall
        ;set Mode_Select On

        print ""
        print "====>> Set Mark Points <<===="

        ;Freeze aircraft position
        set Freeze On

        turn Function_Knob NAV
        turn Data_knob POS
        Wait /time = 1.0
        set Mark On

        Verify_Alpha_Display "MKA"

        ;Record/save the present aircraft position values
        ;for later comparison.

        ;Save the LMD values
        Mem_Copy IF04_2  Mission_Planning_1
        Mem_Copy IF04_5  Mission_Planning_2
        Mem_Copy IF04_6  Mission_Planning_3

        ;Save the RMD values
        Mem_Copy IF04_4  Mission_Planning_4
        Mem_Copy IF04_7  Mission_Planning_5
        Mem_Copy IF04_8  Mission_Planning_6

        ;Translate leading zeroes into blanks if present
        ;in either LMD or RMD displays.
LMDA:   Check/No_Report Mission_Planning_2 = 0  000F
          Jump RMDA
        or Mission_Planning_2  000F     ;change msd of LMD to blank

RMDA:   Check/No_Report Mission_Planning_5 = 0  00F0
          Jump RMDA2
        or Mission_Planning_5  00F0     ;change msd of RMD to blank

        Check/No_Report Mission_Planning_5 = 0  000F
          Jump RMDA2
        or Mission_Planning_5  000F     ;change 4th lsd of LMD to blank

RMDA2:  nop

        ;Fly the aircraft a little more.
        set Freeze Off
        Wait /time = 10.0
        set Freeze On

        turn Function_Knob NAV
        turn Data_knob POS
        Wait /time = 1.0
        set Mark On

        Verify_Alpha_Display "MKB"

        ;Record/save the present aircraft position values
        ;for later comparison.

        ;Save the LMD values
        Mem_Copy IF04_2  Mission_Planning_7
        Mem_Copy IF04_5  Mission_Planning_8
        Mem_Copy IF04_6  Mission_Planning_9

        ;Save the RMD values
        Mem_Copy IF04_4  Mission_Planning_10
        Mem_Copy IF04_7  Mission_Planning_11
        Mem_Copy IF04_8  Mission_Planning_12

        ;Translate leading zeroes into blanks if present
        ;in either LMD or RMD displays.
LMDB:   Check/No_Report Mission_Planning_8 = 0  000F
          Jump RMDB
        or Mission_Planning_8  000F     ;change msd of LMD to blank

RMDB:   Check/No_Report Mission_Planning_11 = 0  00F0
          Jump RMDB2
        or Mission_Planning_11  00F0     ;change msd of RMD to blank

        Check/No_Report Mission_Planning_11 = 0  000F
          Jump RMDB2
        or Mission_Planning_11  000F     ;change 4th lsd of LMD to blank

RMDB2:  nop

        ;Fly the aircraft a little more.
        set Freeze Off
        Wait /time = 10.0
        set Freeze On

        turn Function_Knob NAV
        turn Data_knob POS
        Wait /time = 1.0
        set Mark On

        Verify_Alpha_Display "MKC"

        ;Record/save the present aircraft position values
        ;for later comparison.

        ;Save the LMD values
        Mem_Copy IF04_2  Mission_Planning_13
        Mem_Copy IF04_5  Mission_Planning_14
        Mem_Copy IF04_6  Mission_Planning_15

        ;Save the RMD values
        Mem_Copy IF04_4  Mission_Planning_16
        Mem_Copy IF04_7  Mission_Planning_17
        Mem_Copy IF04_8  Mission_Planning_18

        ;Translate leading zeroes into blanks if present
        ;in either LMD or RMD displays.
LMDC:   Check/No_Report Mission_Planning_14 = 0  000F
          Jump RMDC
        or Mission_Planning_14  000F     ;change msd of LMD to blank

RMDC:   Check/No_Report Mission_Planning_17 = 0  00F0
          Jump RMDC2
        or Mission_Planning_17  00F0     ;change msd of RMD to blank

        Check/No_Report Mission_Planning_17 = 0  000F
          Jump RMDC2
        or Mission_Planning_17  000F     ;change 4th lsd of LMD to blank

RMDC2:  nop
        set Freeze Off

        print ""
        print "====>> Set Mark Points Complete <<===="


        print ""
        print "====>> Verify Mark Points <<===="

        turn Function_Knob NAV
        turn Data_knob DEST
        set Thumbwheel A
        set Spare_Button Off
        Wait /time = 2.0

        ;The following statements verify the values displayed
```

```
        ;in the LMD and RMD against previously saved values.
        ;Actual OFP specifies they must be within +/- 0.1

        ;Check LMD
        Mem_Check IF04_2 = Mission_Planning_1  0001
          Jump NE_LMDA
        Mem_Check IF04_5 = Mission_Planning_2  000F
          Jump NE_LMDA
        Mem_Check IF04_6 = Mission_Planning_3  0FFFF
          Jump NE_LMDA
        Print_Msg "Thumbwheel A LMD Verification" PASS
        Jump Vfy_RMDA

NE_LMDA: Print_Msg "Thumbwheel A LMD Verification" FAIL

        ;Check RMD
Vfy_RMDA: Nop
        Mem_Check IF04_4 = Mission_Planning_4  0001
          Jump NE_RMDA
        Mem_Check IF04_7 = Mission_Planning_5  00FF
          Jump NE_RMDA
        Mem_Check IF04_8 = Mission_Planning_6  0FFFF
          Jump NE_RMDA
        Print_Msg "Thumbwheel A RMD Verification" PASS
        Jump Vfy_LMDB

NE_RMDA: Print_Msg "Thumbwheel A RMD Verification" FAIL

Vfy_LMDB: Nop
        turn Function_Knob NAV
        turn Data_knob DEST
        set Thumbwheel B
        set Spare_Button Off
        Wait /time = 2.0

        ;The following statements verify the values displayed
        ;in the LMD and RMD against previously saved values.
        ;Actual OFP specifies they must be within +/- 0.1

        ;Check LMD
        Mem_Check IF04_2 = Mission_Planning_7  0001
          Jump NE_LMDB
        Mem_Check IF04_5 = Mission_Planning_8  000F
          Jump NE_LMDB
        Mem_Check IF04_6 = Mission_Planning_9  0FFFF
          Jump NE_LMDB
        Print_Msg "Thumbwheel B LMD Verification" PASS
        Jump Vfy_RMDB

NE_LMDB: Print_Msg "Thumbwheel B LMD Verification" FAIL

        ;Check RMD
Vfy_RMDB: Nop
        Mem_Check IF04_4 = Mission_Planning_10  0001
          Jump NE_RMDB
        Mem_Check IF04_7 = Mission_Planning_11  00FF
          Jump NE_RMDB
        Mem_Check IF04_8 = Mission_Planning_12  0FFFF
          Jump NE_RMDB
        Print_Msg "Thumbwheel B RMD Verification" PASS
        Jump Vfy_LMDC

NE_RMDB: Print_Msg "Thumbwheel B RMD Verification" FAIL

Vfy_LMDC: Nop
        turn Function_Knob NAV
        turn Data_knob DEST
        set Thumbwheel C
        set Spare_Button Off
        Wait /time = 2.0

        ;The following statements verify the values displayed
        ;in the LMD and RMD against previously saved values.
        ;Actual OFP specifies they must be within +/- 0.1

        ;Check LMD
        Mem_Check IF04_2 = Mission_Planning_13  0001
          Jump NE_LMDC
        Mem_Check IF04_5 = Mission_Planning_14  000F
          Jump NE_LMDC
        Mem_Check IF04_6 = Mission_Planning_15  0FFFF
          Jump NE_LMDC
        Print_Msg "Thumbwheel C LMD Verification" PASS
        Jump Vfy_RMDC

NE_LMDC: Print_Msg "Thumbwheel C LMD Verification" FAIL

        ;Check RMD
Vfy_RMDC: Nop
        Mem_Check IF04_4 = Mission_Planning_16  0001
          Jump NE_RMDC
        Mem_Check IF04_7 = Mission_Planning_17  00FF
          Jump NE_RMDC
        Mem_Check IF04_8 = Mission_Planning_18  0FFFF
          Jump NE_RMDC
        Print_Msg "Thumbwheel C RMD Verification" PASS
        Jump FIN_MD

NE_RMDC: Print_Msg "Thumbwheel C RMD Verification" FAIL

FIN_MD: Nop

        set Freeze Off

        print ""
        print "=====>> Verify Mark Points Complete <<====="


        print ""
        print "=====>> Flight Complete <<====="


}
```

```
path() {
! Scenario Option:  Scenario_3
!
! Description:
!     This scenario enters Route Details data and
!     Target Geometry data.  The data is verified,
!     the aircraft takes off and flies a short time,
!     and the data is verified again.
!


        ;Load initialization files
        $ $MAC_ROOT/MAC_AVL_LOAD_COND.S TSTCAS
        set ICMode ON

        set Fcc_Pwr On

        print ""
        print "=====>> Beacon, VIP, VRP Data Entry <<====="

        print ""
        print "    Beacon Target Geometry Data"
        turn Function_Knob NAV
        turn Data_knob BCN

        Wait /time = 1.0
        ;Put Data Opt in a known common position
        Data_Opt_To "B/R"
        Enter_LMD "+ 2493"   ;Beacon bearing
        Enter_RMD "+  1578"   ;Beacon range
        set Data_Opt On
        Enter_LMD "-  868"   ;Beacon elevation
        Enter_RMD "+   167"   ;Beacon Time Delay
        Data_Opt_To "B/R"

        print ""
        print "    VIP Target Geometry Data"
        turn Function_Knob NAV
        turn Data_knob WPN_DEL

        Wait /time = 1.0
        ;Put Data Opt in a known common position
        Data_Opt_To "VIP"
        set Data_Opt On
        Enter_LMD "+ 1867"   ;VIP bearing
        Enter_RMD "+  9086"   ;VIP range
        set Data_Opt On
        Enter_LMD "+13471"   ;VIP elevation
        set Data_Opt On
        Enter_LMD "+  491"   ;VIP Delta Bomb Range X
        Enter_RMD "+   376"   ;VIP Delta Bomb Range Y

        print ""
        print "    VRP Target Geometry Data"
        turn Function_Knob NAV
        turn Data_knob WPN_DEL

        Wait /time = 1.0
        ;Put Data Opt in a known common position
        Data_Opt_To "VRP"
        set Data_Opt On
        Enter_LMD "+ 2974"   ;VRP bearing
        Enter_RMD "+  8722"   ;VRP range
        set Data_Opt On
        Enter_LMD "+ 7725"   ;VRP elevation
        Data_Opt_To "VRP"

        print ""
        print "=====>> ILS Localizer Data Entry <<====="

        print ""
        print "    ILS Localizer Data"
        turn Function_Knob NAV
        turn Data_Knob MISC
        Wait /time = 1.0
        Data_Opt_To "LOC"
        Enter_LMD "+  162"   ;ILS Localizer

        print ""
        print "=====>> Manual Ballistics Data Entry <<====="

        print ""
        print "    Manual Ballistics Data"
        turn Function_Knob NAV
        turn Data_knob WPN_DEL

        Wait /time = 1.0
        ;set Mode_Select On
        ;Put Data Opt in a known common position
        Data_Opt_To "R/T"
        Enter_LMD "+ 6334"   ;Manual Ballistics Range
        Enter_RMD "+   363"   ;Manual Ballistics Time-of-Fall
        ;set Mode_Select On

        print ""
        print "=====>> IFF Advisories Data Entry <<====="

        print ""
        print "    IFF Advisory Data"
        turn Function_Knob NAV
        turn Data_knob TISL

        Wait /time = 1.0
        ;Put Data Opt in a known common position
        ;Data_Opt_To "IFF"
        ;LMD displays time to next advisory
        Enter_RMD "+    16"   ;IFF Time Between Advisories

        print ""
        print "=====>> TACAN Data Entry <<====="

        print ""
        print "    TACAN Data"
        turn Function_Knob TCN_FIX

        Wait /time = 2.0
        ;Put Data Opt in a known common position
        ;Data_Opt_To "B/R"
        Enter_LMD "+ 3186"   ;TACAN bearing
        Enter_RMD "+   885"   ;TACAN range

        print ""
        print "=====>> OFP IDENTIFICATION <<====="

        turn Function_Knob NAV
        turn Data_Knob MISC
        Wait /time = 1.0
        ; Push Data Opt 3 times
        set Data_Opt On
        set Data_Opt On
        set Data_Opt On
        ;Alpha Display of FCC OFP
        set Data_Opt On    ;DATA OPT 4
        ;Alpha Display of AIFF OFP
        set Data_Opt On    ;DATA OPT 5

        print ""
        print "=====>> Altitude Calibration Data Entry <<====="

        print ""
        print "    Altitude Limit Data"
        turn Function_Knob NAV
        turn Data_knob ALT_CAL
        Wait /time = 1.0
        ;Put Data Opt in a known common position
        Data_Opt_To "AGL"
        set Data_Opt On
        Enter_LMD "+ 1063"   ;MSL Altitude Limit
        Data_Opt_To "AGL"
        Enter_LMD "+  291"   ;AGL Altitude Limit

        print ""
        print "    Automatic D-VAL Calibration (Align Elevation)"
        turn Function_Knob NAV
        turn Data_knob POS
        Wait /time = 1.0
        Data_Opt_To "E/A"
        Enter_LMD "+ 2991"   ;Alignment Elevation

        print ""
        print "=====>> Energy Management Data Entry <<====="
        print ""
        print "    Fuel Bingo Data"
        turn Function_Knob NAV
        turn Data_knob Cruise
        Wait /time = 1.0
        Data_Opt_To "BGO"
        Enter_LMD "+ 1173"   ;Bingo fuel


        print ""
        print "=====>> Mode Switching <<====="

        set Data_Opt On
        set Mode_Select On
        turn Function_Knob RDR_FIX
        turn Data_knob TISL
        turn Function_Knob STOR_HDG
        turn Data_knob ALT_CAL
        turn Function_Knob SP
        turn Data_knob WIND
        turn Function_Knob HUD_FIX
        turn Data_Knob MISC
        set Data_Opt On
        set Mode_Select On
        turn Function_Knob RDR_FIX
        set Data_Opt On
```

```
set Mode_Select On
turn Data_knob TISL
set Data_Opt On
set Mode_Select On
set Mode_Select On
turn Function_Knob NORM
turn Function_Knob SP
turn Data_knob WIND
turn Function_Knob HUD_FIX
turn Data_Knob MISC
turn Function_Knob RDR_FIX
turn Data_knob TISL
turn Function_Knob STOR_HDG
turn Data_knob ALT_CAL
set Data_Opt On
set Mode_Select On

;Cycle FCC power
;set Landing_Gear Up   ;do this so the FCC comes back up faster
Toggle_On FCC_PWR 2.0
wait /time = 2.0   ;wait for power to be turned on

turn Function_Knob TCN_FIX
set Data_Opt On
set Mode_Select On
turn Data_knob WPN_DEL
set Data_Opt On
set Mode_Select On
set Data_Opt On
set Mode_Select On
set Mode_Select On
turn Function_Knob RDR_FIX
turn Function_Knob OFF
turn Data_knob Cruise
turn Function_Knob NAV
turn Data_knob DEST
turn Function_Knob OVERFLY
turn Data_knob BCN
turn Function_Knob CAL
turn Data_knob TEST
turn Function_Knob OFF
turn Data_knob Cruise
set Data_Opt On
set Mode_Select On
set Data_Opt On
set Mode_Select On
set Data_Opt On
set Mode_Select On
set Data_Opt On
set Mode_Select On

print ""
print "=====>> Energy Management Data Verification <<====="
print ""
print ""
print "    Fuel Bingo Data"
turn Function_Knob NAV
turn Data_knob Cruise
Wait /time = 1.0
Data_Opt_To "BGO"
Verify_LMD "+ 1173"   ;Bingo fuel

print ""
print "=====>> ILS Localizer Data Verification <<====="
print ""

print ""
print "    ILS Localizer Data"
turn Function_Knob NAV
turn Data_Knob MISC
Wait /time = 1.0
Data_Opt_To "LOC"
Verify_LMD "+  162"   ;ILS Localizer

print ""
print "=====>> TACAN Data Verification <<====="
print ""

print ""
print "    TACAN Data"
turn Function_Knob TCN_FIX

Wait /time = 2.0
;Put Data Opt in a known common position
;Data_Opt_To "B/R"
Verify_RMD "+   885"   ;TACAN range
Verify_LMD "+ 3186"   ;TACAN bearing

print ""
print "=====>> Beacon, VIP, VRP Data Verification <<====="
print ""

print ""
print "    VIP Target Geometry Data"
turn Function_Knob NAV
turn Data_knob WPN_DEL

Wait /time = 1.0
;Put Data Opt in a known common position
Data_Opt_To "VIP"
set Data_Opt On
Verify_LMD "+ 1867"   ;VIP bearing
Verify_RMD "+  9086"   ;VIP range
set Data_Opt On
Verify_LMD "+13471"   ;VIP elevation
set Data_Opt On
Verify_LMD "+  491"   ;VIP Delta Bomb Range X
Verify_RMD "+   376"   ;VIP Delta Bomb Range Y
Data_Opt_To "VIP"

print ""
print "    VRP Target Geometry Data"
turn Function_Knob NAV
turn Data_knob WPN_DEL

Wait /time = 1.0
;Put Data Opt in a known common position
Data_Opt_To "VRP"
set Data_Opt On
set Data_Opt On
Verify_LMD "+ 7725"   ;VRP elevation
Data_Opt_To "VRP"
set Data_Opt On
Verify_LMD "+ 2974"   ;VRP bearing
Verify_RMD "+  8722"   ;VRP range

print ""
print "    Beacon Target Geometry Data"
turn Function_Knob NAV
turn Data_knob BCN

Wait /time = 1.0
;Put Data Opt in a known common position
Data_Opt_To "B/R"
Verify_LMD "+ 2493"   ;Beacon bearing
Verify_RMD "+  1578"   ;Beacon range
set Data_Opt On
Data_Opt_To "B/R"
set Data_Opt On
Verify_LMD "-  868"   ;Beacon elevation
Verify_RMD "+   167"   ;Beacon Time Delay

print ""
print "=====>> Altitude Calibration Data Verification <<====="
print ""

print ""
print "    Automatic D-VAL Calibration (Align Elevation)"
turn Function_Knob NAV
turn Data_knob POS
Wait /time = 1.0
Data_Opt_To "E/A"
Verify_LMD "+ 2991"   ;Alignment Elevation

print ""
print "    Altitude Limit Data"
turn Function_Knob NAV
turn Data_knob ALT_CAL
Wait /time = 1.0
;Put Data Opt in a known common position
Data_Opt_To "AGL"
Verify_LMD "+  291"   ;AGL Altitude Limit
set Data_Opt On
Verify_LMD "+ 1063"   ;MSL Altitude Limit
Data_Opt_To "AGL"

print ""
print "=====>> IFF Advisories Data Verification <<====="
print ""

print ""
print "    IFF Advisory Data"
turn Function_Knob NAV
turn Data_knob TISL

Wait /time = 1.0
;Put Data Opt in a known common position
;Data_Opt_To "IFF"
Verify_RMD "+    16"   ;IFF Time Between Advisories
;LMD displays time to next advisory

print ""
print "=====>> Manual Ballistics Data Verification <<====="
print ""

print ""
```

```
print "    Manual Ballistics Data"
turn Function_Knob NAV
turn Data_knob WPN_DEL

Wait /time = 1.0
;set Mode_Select On
;Put Data Opt in a known common position
Data_Opt_To "R/T"
Verify_LMD "+ 6334"   ;Manual Ballistics Range
Verify_RMD "+   363"   ;Manual Ballistics Time-of-Fall
;set Mode_Select On

print ""
print "=====>> TAKEOFF <<====="

;TakeOff Conditions Set
Airspeed 600
Climb 25
set Landing_Gear Up
Altitude 20000

print "=====>> TAKEOFF COMPLETE <<====="
print ""


print ""
print "=====>> FLIGHT <<====="

;Fly the aircraft a short time
Wait /time = 10.0


print ""
print "=====>> Mode Switching <<====="

turn Function_Knob SP
turn Data_knob WIND
turn Function_Knob HUD_FIX
turn Data_Knob MISC
turn Function_Knob RDR_FIX
turn Data_knob TISL
set Data_Opt On
set Mode_Select On
turn Function_Knob STOR_HDG
set Data_Opt On
set Mode_Select On
turn Data_knob ALT_CAL
set Data_Opt On
set Mode_Select On
set Data_Opt On
set Mode_Select On
set Mode_Select On
turn Function_Knob OVERFLY
turn Function_Knob AUX
turn Data_Knob SPARE
turn Function_Knob ATTD
turn Data_knob STRG
turn Function_Knob NORM
turn Data_knob POS
turn Function_Knob TCN_FIX
turn Data_knob WPN_DEL
turn Function_Knob AUX
turn Data_Knob SPARE
set Data_Opt On
set Mode_Select On

;Cycle FCC power
;set Landing_Gear Up   ;do this so the FCC comes back up faster
Toggle_On FCC_PWR 2.0
wait /time = 2.0   ;wait for power to be turned on

set Data_Opt On
set Mode_Select On
set Data_Opt On
set Mode_Select On
set Mode_Select On
turn Function_Knob NORM
turn Function_Knob SP
turn Data_knob WIND
turn Function_Knob HUD_FIX
turn Data_Knob MISC
turn Function_Knob RDR_FIX
turn Data_knob TISL
turn Function_Knob STOR_HDG
turn Data_knob ALT_CAL
turn Function_Knob SP
turn Data_knob WIND
set Data_Opt On
set Mode_Select On
set Data_Opt On
set Mode_Select On
set Data_Opt On
set Mode_Select On
set Data_Opt On
set Mode_Select On
set Mode_Select On
turn Function_Knob RDR_FIX

print ""
print "=====>> TACAN Data Verification <<====="
print ""

print ""
print "    TACAN Data"
turn Function_Knob TCN_FIX

Wait /time = 2.0
;Put Data Opt in a known common position
;Data_Opt_To "B/R"
Verify_RMD "+   885"   ;TACAN range
Verify_LMD "+ 3186"   ;TACAN bearing

print ""
print "=====>> Energy Management Data Verification <<====="
print ""
print ""
print "    Fuel Bingo Data"
turn Function_Knob NAV
turn Data_knob Cruise
Wait /time = 1.0
Data_Opt_To "BGO"
Verify_LMD "+ 1173"   ;Bingo fuel

print ""
print "=====>> ILS Localizer Data Verification <<====="
print ""

print ""
print "    ILS Localizer Data"
turn Function_Knob NAV
turn Data_Knob MISC
Wait /time = 1.0
Data_Opt_To "LOC"
Verify_LMD "+  162"   ;ILS Localizer

print ""
print "=====>> Beacon, VIP, VRP Data Verification <<====="
print ""

print ""
print "    VRP Target Geometry Data"
turn Function_Knob NAV
turn Data_knob WPN_DEL

Wait /time = 1.0
;Put Data Opt in a known common position
Data_Opt_To "VRP"
set Data_Opt On
set Data_Opt On
Verify_LMD "+ 7725"   ;VRP elevation
Data_Opt_To "VRP"
set Data_Opt On
Verify_LMD "+ 2974"   ;VRP bearing
Verify_RMD "+  8722"   ;VRP range

print ""
print "    Beacon Target Geometry Data"
turn Function_Knob NAV
turn Data_knob BCN

Wait /time = 1.0
;Put Data Opt in a known common position
Data_Opt_To "B/R"
Verify_LMD "+ 2493"   ;Beacon bearing
Verify_RMD "+  1578"   ;Beacon range
set Data_Opt On
Data_Opt_To "B/R"
set Data_Opt On
Verify_LMD "-  868"   ;Beacon elevation
Verify_RMD "+   167"   ;Beacon Time Delay

print ""
print "    VIP Target Geometry Data"
turn Function_Knob NAV
turn Data_knob WPN_DEL

Wait /time = 1.0
;Put Data Opt in a known common position
Data_Opt_To "VIP"
set Data_Opt On
Verify_RMD "+  9086"   ;VIP range
set Data_Opt On
Verify_LMD "+13471"   ;VIP elevation
set Data_Opt On
Verify_LMD "+  491"   ;VIP Delta Bomb Range X
Verify_RMD "+   376"   ;VIP Delta Bomb Range Y
```

```
Data_Opt_To "VIP"
set Data_Opt On
Verify_LMD "+ 1867"   ;VIP bearing

print ""
print "=====>> Altitude Calibration Data Verification <<====="
print ""

print ""
print "    Altitude Limit Data"
turn Function_Knob NAV
turn Data_knob ALT_CAL
Wait /time = 1.0
;Put Data Opt in a known common position
Data_Opt_To "AGL"
Verify_LMD "+  291"   ;AGL Altitude Limit
set Data_Opt On
Verify_LMD "+ 1063"   ;MSL Altitude Limit
Data_Opt_To "AGL"

print ""
print "    Automatic D-VAL Calibration (Align Elevation)"
turn Function_Knob NAV
turn Data_knob POS
Wait /time = 1.0
Data_Opt_To "E/A"
Verify_LMD "+ 2991"   ;Alignment Elevation

print ""
print "=====>> IFF Advisories Data Verification <<====="
print ""

print ""
print "    IFF Advisory Data"
turn Function_Knob NAV
turn Data_knob TISL

Wait /time = 1.0
;Put Data Opt in a known common position
;Data_Opt_To "IFF"
;LMD displays time to next advisory
Verify_RMD "+    16"   ;IFF Time Between Advisories

print ""
print "=====>> Manual Ballistics Data Verification <<====="
print ""

print ""
print "    Manual Ballistics Data"
turn Function_Knob NAV
turn Data_knob WPN_DEL

Wait /time = 1.0
;set Mode_Select On
;Put Data Opt in a known common position
Data_Opt_To "R/T"
Verify_LMD "+ 6334"   ;Manual Ballistics Range
Verify_RMD "+   363"   ;Manual Ballistics Time-of-Fall
;set Mode_Select On

print ""
print "=====>> Flight Complete <<====="

}
```

```
path() {
! Scenario Option:  Scenario_4
!
! Description:
!     Mark points are set and verified.
!


        ;Load initialization files
        $ $MAC_ROOT/MAC_AVL_LOAD_COND.S TSTCAS
        set ICMode ON

        set Fcc_Pwr On


        print ""
        print "=====>> TAKEOFF <<====="

        ;TakeOff Conditions Set
        Airspeed 600
        Climb 25
        set Landing_Gear Up
        Altitude 20000

        print "=====>> TAKEOFF COMPLETE <<====="
        print ""


        print ""
        print "=====>> FLIGHT <<====="

        ;Fly the aircraft a short time
        Wait /time = 10.0


        print ""
        print "=====>> Set Mark Points <<====="

        ;Freeze aircraft position
        set Freeze On

        turn Function_Knob NAV
        turn Data_knob POS
        Wait /time = 1.0
        set Mark On

        Verify_Alpha_Display "MKA"

        ;Record/save the present aircraft position values
        ;for later comparison.

        ;Save the LMD values
        Mem_Copy IF04_2  Mission_Planning_1
        Mem_Copy IF04_5  Mission_Planning_2
        Mem_Copy IF04_6  Mission_Planning_3

        ;Save the RMD values
        Mem_Copy IF04_4  Mission_Planning_4
        Mem_Copy IF04_7  Mission_Planning_5
        Mem_Copy IF04_8  Mission_Planning_6

        ;Translate leading zeroes into blanks if present
        ;in either LMD or RMD displays.
LMDA:   Check/No_Report Mission_Planning_2 = 0  000F
          Jump RMDA
        or Mission_Planning_2  000F     ;change msd of LMD to blank

RMDA:   Check/No_Report Mission_Planning_5 = 0  00F0
          Jump RMDA2
        or Mission_Planning_5  00F0     ;change msd of RMD to blank

        Check/No_Report Mission_Planning_5 = 0  000F
          Jump RMDA2
        or Mission_Planning_5  000F     ;change 4th lsd of LMD to blank

RMDA2:  nop

        ;Fly the aircraft a little more.
        set Freeze Off
        Wait /time = 10.0
        set Freeze On

        turn Function_Knob NAV
        turn Data_knob POS
        Wait /time = 1.0
        set Mark On

        Verify_Alpha_Display "MKB"

        ;Record/save the present aircraft position values
        ;for later comparison.

        ;Save the LMD values
        Mem_Copy IF04_2  Mission_Planning_7
        Mem_Copy IF04_5  Mission_Planning_8
        Mem_Copy IF04_6  Mission_Planning_9

        ;Save the RMD values
        Mem_Copy IF04_4  Mission_Planning_10
        Mem_Copy IF04_7  Mission_Planning_11
        Mem_Copy IF04_8  Mission_Planning_12

        ;Translate leading zeroes into blanks if present
        ;in either LMD or RMD displays.
LMDB:   Check/No_Report Mission_Planning_8 = 0  000F
          Jump RMDB
        or Mission_Planning_8  000F     ;change msd of LMD to blank

RMDB:   Check/No_Report Mission_Planning_11 = 0  00F0
          Jump RMDB2
        or Mission_Planning_11  00F0     ;change msd of RMD to blank

        Check/No_Report Mission_Planning_11 = 0  000F
          Jump RMDB2
        or Mission_Planning_11  000F     ;change 4th lsd of LMD to blank

RMDB2:  nop

        ;Fly the aircraft a little more.
        set Freeze Off
        Wait /time = 10.0
        set Freeze On

        turn Function_Knob NAV
        turn Data_knob POS
        Wait /time = 1.0
        set Mark On

        Verify_Alpha_Display "MKC"

        ;Record/save the present aircraft position values
        ;for later comparison.

        ;Save the LMD values
        Mem_Copy IF04_2  Mission_Planning_13
        Mem_Copy IF04_5  Mission_Planning_14
        Mem_Copy IF04_6  Mission_Planning_15

        ;Save the RMD values
        Mem_Copy IF04_4  Mission_Planning_16
        Mem_Copy IF04_7  Mission_Planning_17
        Mem_Copy IF04_8  Mission_Planning_18

        ;Translate leading zeroes into blanks if present
        ;in either LMD or RMD displays.
LMDC:   Check/No_Report Mission_Planning_14 = 0  000F
          Jump RMDC
        or Mission_Planning_14  000F     ;change msd of LMD to blank

RMDC:   Check/No_Report Mission_Planning_17 = 0  00F0
          Jump RMDC2
        or Mission_Planning_17  00F0     ;change msd of RMD to blank

        Check/No_Report Mission_Planning_17 = 0  000F
          Jump RMDC2
        or Mission_Planning_17  000F     ;change 4th lsd of LMD to blank

RMDC2:  nop
        set Freeze Off

        print ""
        print "=====>> Set Mark Points Complete <<====="


        print ""
        print "=====>> Verify Mark Points <<====="

        turn Function_Knob NAV
        turn Data_knob DEST
        set Thumbwheel A
        set Spare_Button Off
        Wait /time = 2.0

        ;The following statements verify the values displayed
        ;in the LMD and RMD against previously saved values.
        ;Actual OFP specifies they must be within +/- 0.1

        ;Check LMD
        Mem_Check IF04_2 = Mission_Planning_1  0001
          Jump NE_LMDA
        Mem_Check IF04_5 = Mission_Planning_2  000F
          Jump NE_LMDA
        Mem_Check IF04_6 = Mission_Planning_3  0FFFF
          Jump NE_LMDA
        Print_Msg "Thumbwheel A LMD Verification" PASS
        Jump Vfy_RMDA
```

```
NE_LMDA: Print_Msg "Thumbwheel A LMD Verification" FAIL

        ;Check RMD
Vfy_RMDA: Nop
        Mem_Check IF04_4 = Mission_Planning_4  0001
          Jump NE_RMDA
        Mem_Check IF04_7 = Mission_Planning_5  00FF
          Jump NE_RMDA
        Mem_Check IF04_8 = Mission_Planning_6  0FFFF
          Jump NE_RMDA
        Print_Msg "Thumbwheel A RMD Verification" PASS
        Jump Vfy_LMDB

NE_RMDA: Print_Msg "Thumbwheel A RMD Verification" FAIL

Vfy_LMDB: Nop
        turn Function_Knob NAV
        turn Data_knob DEST
        set Thumbwheel B
        set Spare_Button Off
        Wait /time = 2.0

        ;The following statements verify the values displayed
        ;in the LMD and RMD against previously saved values.
        ;Actual OFP specifies they must be within +/- 0.1

        ;Check LMD
        Mem_Check IF04_2 = Mission_Planning_7  0001
          Jump NE_LMDB
        Mem_Check IF04_5 = Mission_Planning_8  000F
          Jump NE_LMDB
        Mem_Check IF04_6 = Mission_Planning_9  0FFFF
          Jump NE_LMDB
        Print_Msg "Thumbwheel B LMD Verification" PASS
        Jump Vfy_RMDB

NE_LMDB: Print_Msg "Thumbwheel B LMD Verification" FAIL

        ;Check RMD
Vfy_RMDB: Nop
        Mem_Check IF04_4 = Mission_Planning_10  0001
          Jump NE_RMDB
        Mem_Check IF04_7 = Mission_Planning_11  00FF
          Jump NE_RMDB
        Mem_Check IF04_8 = Mission_Planning_12  0FFFF
          Jump NE_RMDB
        Print_Msg "Thumbwheel B RMD Verification" PASS
        Jump Vfy_LMDC

NE_RMDB: Print_Msg "Thumbwheel B RMD Verification" FAIL

Vfy_LMDC: Nop
        turn Function_Knob NAV
        turn Data_knob DEST
        set Thumbwheel C
        set Spare_Button Off
        Wait /time = 2.0

        ;The following statements verify the values displayed
        ;in the LMD and RMD against previously saved values.
        ;Actual OFP specifies they must be within +/- 0.1

        ;Check LMD
        Mem_Check IF04_2 = Mission_Planning_13  0001
          Jump NE_LMDC
        Mem_Check IF04_5 = Mission_Planning_14  000F
          Jump NE_LMDC
        Mem_Check IF04_6 = Mission_Planning_15  0FFFF
          Jump NE_LMDC
        Print_Msg "Thumbwheel C LMD Verification" PASS
        Jump Vfy_RMDC

NE_LMDC: Print_Msg "Thumbwheel C LMD Verification" FAIL

        ;Check RMD
Vfy_RMDC: Nop
        Mem_Check IF04_4 = Mission_Planning_16  0001
          Jump NE_RMDC
        Mem_Check IF04_7 = Mission_Planning_17  00FF
          Jump NE_RMDC
        Mem_Check IF04_8 = Mission_Planning_18  0FFFF
          Jump NE_RMDC
        Print_Msg "Thumbwheel C RMD Verification" PASS
        Jump FIN_MD

NE_RMDC: Print_Msg "Thumbwheel C RMD Verification" FAIL

FIN_MD: Nop

        set Freeze Off

        print ""

        print "=====>> Verify Mark Points Complete <<====="


        print ""
        print "=====>> Flight Complete <<====="


}
```

THIS PAGE INTENTIONALLY LEFT BLANK